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Engineering News-Record

Devoted to Civil Engineering and Contracting

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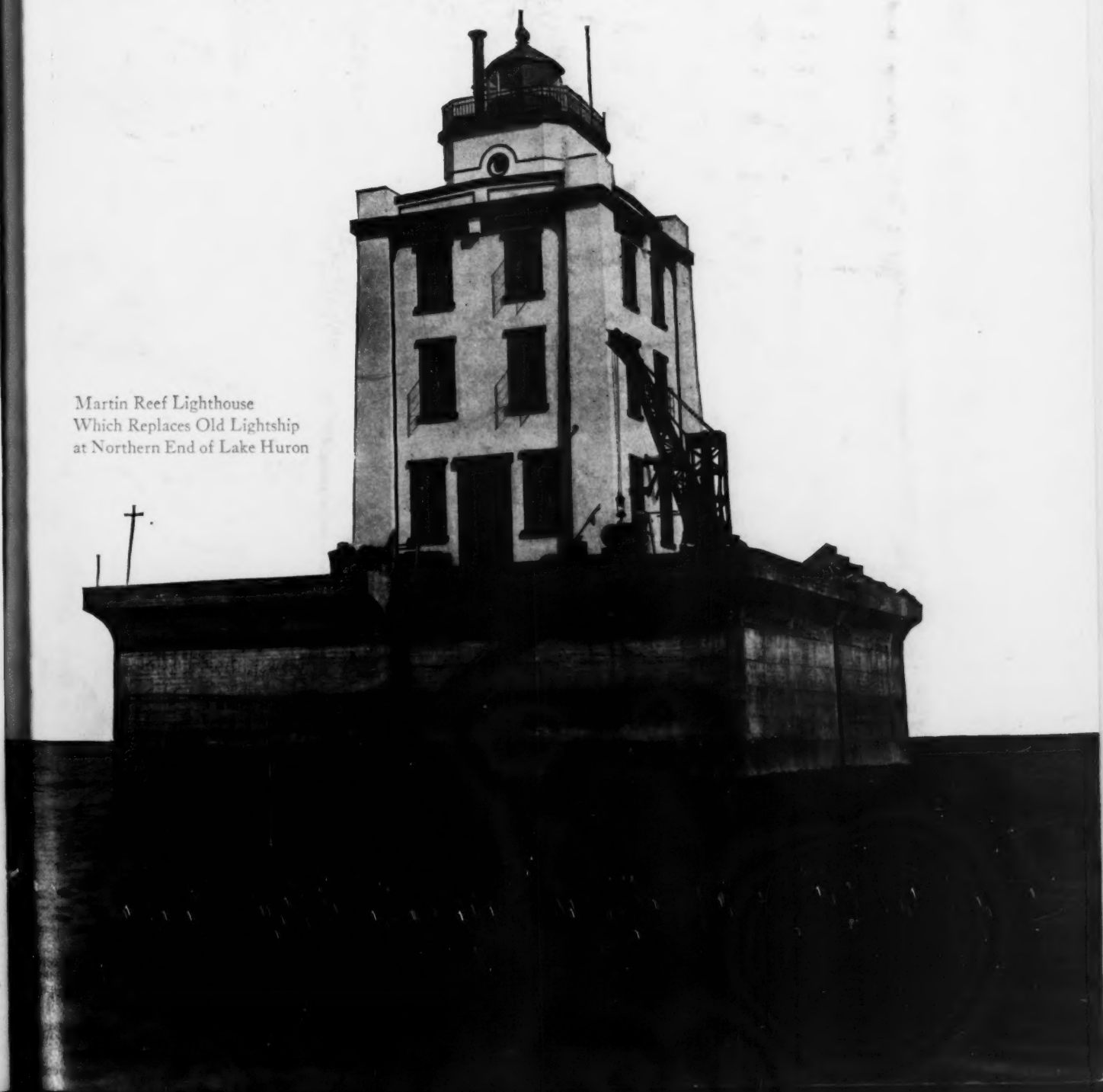

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Volume 101 New York, July 26, 1928 *Number 4*

Engineering News-Record

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Nomads Who Succeed

IN REPLY to a letter asking about his change of address, a subscriber to *Engineering News-Record* writes:

> *"No, I have not taken a new position. My change of address is simply a matter of convenience. I am working for the same concern as before, but the present job is in a new location.*
>
> *"I am a plain worker in engineering construction, but I want my News-Record to get to me on the job regularly, if possible."*

THE man who wrote that letter will not long remain a *plain worker*. There is advancement ahead for anyone whose work is so close to him that he must have his professional magazine follow him wherever he goes.

HERE is a reflection of what has happened daily and hourly during the half century of this journal's existence. Civil engineers and builders of engineering works have always been nomads, assuming a new post-office address with each new job. But most of them early formed the habit of sending in their new address promptly, that they might not miss their paper.

IT IS a habit that spells success; and it has contributed, we venture to say, to the development of the civil engineering profession during the lifetime of *Engineering News-Record*.

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DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

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Volume 101 NEW YORK, JULY 26, 1928 Number 4

Bus Service Expanding

INAUGURATION of transcontinental motor-bus connections this summer brings out with strong emphasis the growth of a new medium of transportation. Bus transportation has grown at an amazing rate for the last half dozen years, and the growth continues without check. Nearly 100,000 buses are now in regular passenger transport service in the United States, more than twice the number of five years ago. The comparison is even more sensational when character of service is considered, for bus operation has been improved in capacity and comfort of vehicle, in schedule frequency, in dependability and continuity of operation, and also in speed, to a degree that makes it difficult to recognize the jitney and the primitive bus in what the traveling public now enjoys. The development has affected urban routes and intercity lines alike. In the city and suburban circle, where street-railway service has stood still, bus routes have been the agency which made expansion of the built-up areas possible, incidentally increasing property values enormously by the greater accessibility which they produced. In long-distance work they have made highway travel popular by matching of schedules, by interline arrangements, and by meal and possible overnight stops. Co-ordination of bus with rail service also has made progress, and by its effect the new medium of transportation is building additional traffic rather than taking business from the older lines. The ultimate outcome of bus development is still a matter for random guess rather than for definite prediction. But it is clear beyond doubt that both the transportation art and the street and road builder's work must reckon most seriously with the possibilities and the demands of the high-speed passenger motor bus.

Speed Grade-Crossing Work

DAILY the country's highways become more crowded with traffic, and daily the untold thousands of points where highways cross railroads at grades become more maleficent danger spots. Much construction is going on to eliminate these crossings, but its total is negligibly small compared with the vast number of remaining grade crossings. At the present rate of progress in separating grades, many decades, even centuries, will be required to complete the work. This is a thoroughly disquieting prospect. Is it not time that more determined thought be given to expediting grade-crossing work? Today everyone knows that the money to do the work must in the end come from the public, in one way or another, and for this reason the rate at which elimination work is carried on need not depend on whether or how the railways share in the cost. It depends only on a well-devised program and on efficient physical methods of separating grades. The former item has had some slight study, but we believe much less than it deserves; an intensive attack by states and cities on the problem of planning an accelerated working program would further the movement effectively. And similarly, design and construction methods would repay more thorough study. Grade separations are too often made an occasion for beautification and general rearrangement of facilities. When these secondary objectives, worthy in themselves, delay or complicate the essential objective of bringing about earliest possible separation of grades, they become mischievous. It is a notorious fact that in many instances such secondary aims have resulted in long postponements and great increase of cost of grade-crossing elimination. The pressing need of the day is for simplest and most economical elimination, carried on progressively and according to a wisely planned program.

Agreement Within Reach

WHILE the problems of Boulder dam are under study, and while the return of Congress to its deliberations on the project next December is being awaited, it is a good time for the states of the Colorado River basin to enter on a new attempt to adjust their respective claims to the river's waters. The 1922 agreement framed at Santa Fe, the much-discussed Colorado River Compact, has now made a six-year record of failure. It is a dead document. Much has been made clear in these six years as to the needs and wishes of the several states. The equities of the case are now much more thoroughly appreciated than they were in 1922, and therefore a new attempt to formulate a division of the waters might have fair hope of succeeding. Last year's attempt failed because it was aimed at mere revision of the old compact. Tinkering with the document around which so many animosities have grown up is virtually foredoomed to failure. But a conference assembled to consider the matter on first principles, with the slate wiped clean of the former attempt, could direct itself to the true objective, that set out by Congress in its original authorization: namely, apportioning the river's waters between the individual states of the basin. The 1922 compact evaded that purpose. A new conference in the light of the present situation would offer fair promise of leading to a harmonious result.

Bids Less Than Estimates

ROAD construction estimated to cost $7,775,140 has been bid in by California contractors for $645,665 less than the estimates. This news is announced by the state director of public works. It is like the news from New York and Indiana and from other states which was published earlier last spring. California road contractors, then, are not different from those in other large road-building states. They can either build roads much more cheaply than highway department engineers figure that they can be built for, or else they are building many roads without profit and perhaps at a loss. As contractors generally in all these states are complaining of low prices and unprofitable operations, it is a reasonable presumption that the last alternative is the true one.

Why, then, do contractors continue to bid below the estimates? Certainly so far as the state highway departments are concerned they could get more for the work than they are getting—in California about 10 per cent more—for highway engineers generally are satisfied that their estimates reflect reasonable costs plus a fair profit and will award contracts at estimated prices if they can do no better. It is not the highway engineers who have cut prices 10 per cent in California; it is the highway contractors. It is so also in the other states. Why? Because in every state there are contractors who bid without knowledge of ultimate costs and hazards and other contractors who bid to beat competition. Also in every state there are contractors—a few—who bid what they know the work will cost plus a profit, and if they cannot get their prices they let their competitors have the contracts. Generally their competitors are getting them, and that is why the director of public works in California and other highway officials in other states can so often gratify their constituency by publishing large savings due to bids under estimates. The situation is none the less a serious one for the sound bidder. News like that from California evidences a sick condition which contracting has to cure by its own efforts.

A Matter of Planning

THE year has 52 weeks, as is well known, and in all conscience this would seem to be enough to accommodate the full range of technical society meetings without conflict of related types. Yet conflicts of meetings are common, and sometimes, as during the past few months, they assume an almost epidemic form. Lack in the co-ordination of society activities must be held responsible for this fact. It should be possible to overcome this trouble in the interests of the members. Societies exist wholly for and by their members' interest, and should guide their actions accordingly. Were this done, the Society for the Promotion of Engineering Education, for example, would not meet in the same week as the American Society for Testing Materials—at a point several hundred miles distant—as it did this summer, not to mention other societies that held meetings in the same week. Many men are interested in the work of both the organizations named, and the arrangement of simultaneous meetings compels them to slight either one or the other. The overlapping of the American Railway Association sessions into the week during which the American Society for Testing Materials was meeting also seems an awkward misadjustment. Necessarily, the managing authorities of societies operate quite independently; but we think they might well keep very insistently in mind the fact that conflicting meetings will reduce the effectiveness of their own work, and accordingly give study to means of preventing such conflicts. The value of a technical society is a direct function of the active participation of its members in its sessions, and society operating methods ought to be shaped accordingly.

Reconstituting an Old Art

A MOVEMENT recently initiated through the Engineering Standards Committee presents a decided innovation in technical society activities. The movement is directed toward formulating a code of good practice in brick masonry construction. Heretofore the Standards Committee has not worked in the field of engineering methods, still less in that of technologic craftsmanship; yet the proposed work, which was characterized by a representative conference as useful and desirable work, is well within the scope of the abilities of the committee. The project has relations to building-code problems on the one hand and to more general engineering and building consideration on the other. It is of broad public importance, moreover, since brickwork today, as for some thousands of years past, is one of the basic elements of construction, and in addition has perhaps greater universality of use and method than any of the other elements, since both brick and brick masonry are closely alike the world over. But as building in brick is to a superlative degree a craft, a manual art, it is largely without a fixed record of best method; and accordingly the manysided practices of building of the present generation tend to raise various doubts concerning its proper performance. Modern systems of construction have little place for the massive brickwork of former days, but require thin walls, which yet must have dependable strength and resistance to fire and weather. The use of strong mortars, the extending practice of building composite walls, and the occurrence of a disquieting number of cases of water leakage through brickwork point to the value of reviewing traditional brick masonry construction methods. By writing a constitution for the art, much empirical knowledge may be preserved from oblivion, and its meaning may be extended by correlating it with modern knowledge. The result should be helpful to brickmaker, mason and engineer alike; the craft as well as its utilization will rest on a broader and sounder base for being reconstituted.

Noisy Construction

TO THE engineer, construction activity and noise are synonymous and inseparable. But the layman's attitude is quite different. To him the ever-present noise of construction operations is an unnecessary evil, and he is not backward about expressing himself on the subject. The construction industry, shortsighted and inconsiderate, has given the layman's feelings no consideration. Oblivious to the feelings of its fellow citizens, it has continued to make noise—useless and unnecessary noise—while at work. In consequence, what were once mere expressions of views and desires are now assuming the character of demands, and engineering construction finds itself confronted by a situation which it cannot long ignore.

Time was when changes in engineering methods and machines were dictated by efficiency—by probable savings in cost or time, and by expediency, all of them considerations within the profession itself. Now, through the progress of urban development, influences from the outside are making themselves felt: the public's demand for safety, quiet and convenience claims at least a share of attention.

Last week a group of businessmen met to consider what could be done about abatement of construction noises, and decided to draft for presentation to the municipal authorities an ordinance that would limit the nuisance by punitive provisions. Among other things, these men cited the serious interference with telephone communication which construction noises cause; the nervous annoyance and (where windows are closed to muffle the noise) the resulting bad effect on health. They listed the unmuffled power shovel, the piledriver, the rivet hammer and steam machines with loose packing boxes

as the chief culprits. Their complaint is entitled to attention.

It should not require hostile legislation to bring about a cure of these conditions. The construction industry has ample organizing and regulating ability within itself to reform its bad practices. The technical problem of noise prevention no doubt is not simple, but we feel certain that it is capable of solution. The absence of mufflers, to begin with, should be easily remedied. The noise produced by steel striking steel is less easy to deal with, and any cushioning would probably reduce efficiency; but if reduction in efficiency is the only alternative to noise it appears plain that sooner or later the construction industry must make the best of it.

At all events ways to reduce noise can be found, and in this modern era they must be found, even at the cost of a complete change of method. Before ordinances make it necessary for engineers, contractors and machinery manufacturers hurriedly to search out ways of noise reduction, may it not be better to conduct a little research now, when time is still available to set about the matter on a leisurely and efficient basis? Ways once found, their application would be next in order.

The problem as a whole is the responsibility of the construction industry itself. Self-imposed rules have always been the easiest to follow. And, moreover, no industry has ever gained by setting itself in opposition to public demand; it is good business to gain and hold the general good will.

Water-Cement-Ratio Roads

ROADBUILDERS who venture with the water-cement-ratio method of designing concrete mixes continue to approach it obliquely. To go back a few weeks for an illustration an example is the paving work at Mundelein, Ill., described in *Engineering News-Record*, June 21, 1928, p. 698. Virtually the specifications necessitated the application of the water-cement-ratio method, while nominally they avoided any commitment of the engineer or the contractor to its use. They called for a minimum strength; they called for precise regulation of the water, including that contained in the aggregates; they named the ratio of coarse to fine aggregate, and they demanded a plastic workable mixture showing a stipulated slump. Obviously the water-cement ratio was prescribed as rigidly almost by this procedure as if "six gallons of water per sack of cement including the water in the sand" had been specified. However, it is not the angle of the engineer's approach to the use of water-cement-ratio concrete in this Illinois paving operation which merits notice so particularly as does his positive assertion that neither the difficulties nor the costs of the work were increased by his variation from ordinary practice.

It is interesting to note confirmation of both these facts by records from New Hampshire, whose highway department is one of the few that frankly acknowledge their commitment to the water-cement-ratio method of designing concrete mixes for road construction. W. F. Purrington, materials engineer of the department, gives the records in a paper read recently before the Boston Society of Civil Engineers. The paper presents evidence that there is no difficulty in applying the method to paving where a traveling mixer is used and the usual aggregate variables exist; that costs show a drop instead of a rise; and that the contractor after one experience is converted to the new method. These conclusions are important. They strike directly at the only real objections that the practical roadbuilder has had to urge against water-cement-ratio concrete roads. Conviction will not come widely until many more proofs are available, nor should there be any hurry to depart from old, tried practices, but such experiences as are mentioned here should keep highway engineers alert to the new concrete roadbuilding practice in course of creation.

Engineering Report Writing

SAID an engineer of long experience recently, "I have seen many engineering reports that were hardly readable; and but few that bring out their essential conclusions concisely and forcibly." Our own experience confirms the indictment. The ability to write a clear, convincing report is undoubtedly one of the prime items of the engineer's equipment. Why, then, the serious shortcomings indicated in the above quotation?

Despite the emphasis placed on the teaching of English and clear expression in the schools during recent years, conditions seem to be improving but slowly if at all. It is doubtful whether practice in writing and knowledge of English composition is the key to the trouble. More probably the power of clear and systematic thinking is at fault. But without attempting at this time to search after the cause of the difficulty we take the liberty of citing an example in contrast, an instance of remarkably effective and forceful summarizing in a report.

The engineers of the National Board of Fire Underwriters, which is continuously engaged in investigating and reporting on water supplies and fire protection in our cities, recently reported on a city of 300,000 or 400,000 people. After making a detailed statement of facts they compressed their essential findings into a 70-word paragraph, and finally further summarized that paragraph in even fewer and more pointed words. It is a performance worth noting by all engineers who have reports to write. We quote the 70-word general summary first:

"Municipal works; records good; emergency operations fair. Supply ample; delivered through eight conduits of ample capacity to the distribution system. Distribution is in two gravity services with equalizing reservoirs, and three services by direct pumpage. Stations not fireproof; equipment adequate. Consumption very high; few meters. Pressures high to low; poorly maintained. Arterial systems strong in central part of the city but weak in some districts. Minor distributors of small size; considerable four-inch; gridironing fair; dead ends fairly numerous. Valves well spaced; condition fairly good. Hydrants widely spaced; of good type and in good condition."

And finally, in large type on the last page of the pamphlet report—a page which doubtless had the most careful thought on the part of the authors—there appears this short, clear statement of where the city's protection is good and where it is weak:

"Water supply mainly adequate and reliable; sufficient quantities generally available for engine supply. Fire department efficient and mainly well equipped. Fire alarm system overloaded, inadequate and unreliable."

Here is an entire city water system characterized in thirteen words! With this effective summarization it is not to be wondered at that the Underwriters' reports are usually followed by prompt construction activity. Such reports accomplish their purpose. But every engineer has to translate his proposals into projects, and to each one, therefore, the ability to place his message in clear, concise and forceful terms is equally vital. He may be able to learn something from the example cited.

First Arc-Welded Railway Truss Bridge

Structure at Chicopee Falls Utilizes Practically All Classes of Welding—Excessive Skew Complicated the Design

By Gilbert D. Fish
Consulting Engineer, Westinghouse Electric & Manufacturing Company, New York City

With all its members connected by direct-current arc-welding, a through truss railroad bridge has been placed in service between the Westinghouse Electric & Manufacturing Company's plant at Chicopee Falls, Mass., and the Boston & Maine Railroad across a canal. There are no rivets in the structure and a minimum number of bolts were used for erection purposes.

The general dimensions of the structure, as well as several of the important details, are shown in Fig. 4. Although the canal is only 50 ft. wide, a 72 deg. skew required a span of 134 ft. 8 in. The truss panel arrangement and all center line dimensions were copied from the riveted layout originally prepared by the railroad engineers. A Cooper's E-50 live-loading specification was followed. The welded structure used about two-thirds of the quantity of steel required by the riveted equivalent, due to saving most of the connection material, to avoidance of holes in tension members and to continuity of floor stringers. About 80 tons of steel was required in the structure. The only interference with true comparison between the alternate forms of construction lies in the substitution of rolled shapes for the built-up sections shown in the riveted design. The cost saving by welding is indicated by the lowest bids on the alternative designs, which were approximately $19,000 for the riveted superstructure and $15,000 for the arc-welded one.

FIG. 1—FIRST TRAIN OVER ARC-WELDED BRIDGE, CHICOPEE FALLS, MASS.

Design for Welding—Since the bridge was designed, in August, 1927, further experience and additional test data have indicated that a more uniform safety factor would result from using higher unit stresses in fillet and slot welds and lower unit tension in butt welds. The stresses used in butt welds were 13,000 lb. per sq.in. tension, 16,000 lb. compression and 9,000 lb. mean shear; in slot welds ½ in. wide, 5,000 lb. per lin.in. shear; and in triangular fillet welds ⅜ in. wide, 2,500 lb. per lin.in. shear.

The lateral forces are assumed as a wind load of 75 lb. per lin.ft. in the planes of the top and bottom chords, and a 375-lb. per lin.ft. moving load on the bottom lateral system. The top-chord wind loads are transferred to the trusses by stiffened bents at panel points 5, 7 and 9.

The impact formula used was $\frac{15{,}000\ S}{30{,}000 + L^2}$, where S equals the live-load stress and L equals the loaded distance in feet; this is one of the so-called "half-impact" formulas suitable for low-speed service and light traffic.

The truss members are beam sections of 10-in. depth, all of them being wide-flanged sections except for a few vertical members consisting of standard I-beams. For a number of the brace members, 6x6x⅜-in. angles are used. The floorbeams are 21-in. wide-flanged sections provided with cover plates, except for the short beams at the abutments. The stringers are standard 12-in. I-beams, made continuous at the floor beams by special welded joints shown in detail in Fig. 4. The top flanges of the stringers are braced by strut angles and diagonal bars, welded in place without erection bolts. Kneebraces consist of single angles, mitered but not otherwise fabricated. The minimum thickness of metal in the structure is about ⅜ in. In one of the accompanying tables are given the stresses in the various truss members.

Joint Details—Welding details include welds of nearly all recognized classes. The gusseted truss joints are suggestive of riveted joints, each member exchanging reaction with the plates through lines of shear welds instead of rows of rivets. On account of the higher concentration of strength made possible by the welding, the gussets are only about one-fourth as large as for riveted joints. Many joints of less importance are detailed without gussets, erection purposes being served by one or two clip angles or straps. The bottom-chord splices and the end joints are developed mainly by tension butt welds, with assistance from side plates connected by shear welds.

At every butt weld, whether for tension or compression, one of the abutting members was prepared by beveling the flanges at 45 deg. on the outside. At the bottom-chord splices near L3 and L7 the web of the member with beveled flanges was also beveled in order to provide for butt welding the entire cross-section of the member.

One of the butt welds at a lower chord splice cracked, due to initial cooling tension, after a week of service. This occurrence brings up a point from which a useful conclusion can be drawn. The weld in question, which joined the webs of the two members, was made after the flanges on both sides had been welded solid and was therefore unable to draw the members any closer to each other when cooling. The resulting tension in the web weld was sufficiently high to cause it to crack after it had been

loaded several times; the other butt welds and the fillet welds, not having been subject to the same condition, were more than ample to take the suddenly applied extra load and were not injured, because even the instantaneous stress did not approach the elastic limit.

These splice welds represented 75 per cent instead of 100 per cent of the strength of the chord itself. The 25 per cent deficiency could have been avoided either by peening the final butt weld so as to remove cooling tension or, more simply, by omitting the web weld and using additional splice bars with fillet welding. The former precaution was used in replacing the cracked weld, and splice bar reinforcement was applied to the other splices where a similar condition might exist.

STRESSES IN TRUSS MEMBERS (In 1,000-lb. units.)

Member	Dead Load	Live Load	Impact	Total	½ Dead	Counter Live	Counter Impact	Total Plus ½ Counter	Section
L0 L3	+33	+117	+37	+187	.....	....	....	....	10 CB 42
L3 L7	+70	+283	+88	+441	.....	....	....	....	10 CB 92
L7 L11	+41	+194	+63	+298	.....	....	....	....	10 CB 63
U1 L3	+39	+187	+68	+294	.....	....	....	....	10 CB 63
L7 U9	+33	+160	+60	+253	+22	—18	—9	+256	10 CB 56
U1 L1	+ 9	+ 19	+ 9	+ 37	.....	....	....	....	10 I 30
U5 L5, U9 L9	+12	+ 91	+42	+145	.....	....	....	....	10 CB 49
M10 L10, etc.	+ 6	+ 57	+28	+ 91	.....	....	....	....	10 I 30
L0 U1	—51	—183	—57	—291	.....	....	....	....	10 CB 100
U1 U5	—57	—213	—67	—337	.....	....	....	....	10 CB 100
U5 U9	—61	—248	—78	—387	.....	....	....	....	10 CB 116
U9 L11	—60	—283	—88	—431	.....	....	....	....	*10 CB 124
L3 U5	—19	—141	—58	—218	—13	+31	+14	—234	10 CB 84
U5 L7	—13	—112	—47	—172	— 9	+54	+25	—207	10 CB 77
U3 L3, U7 L7	— 5	0	0	— 5	.....	....	....	....	10 I 30
L9 M10, etc.	— 4	— 40	—19	— 63	.....	....	....	....	10 CB 49

*U9 L11 has two 40-lb. tee rails 13 ft. long to increase radius of gyration.

The weld metal in the cracked weld was removed by drilling a line of holes and cutting it out. Examination showed that this cracked weld was of good crystal structure and above the average good weld, being free of gas pockets and slag inclusions.

Butt Welds Vs. Fillet Welds—The general question of the suitability and economy of very large butt welds in structures is a subject for much further study. It would be unwise to condemn butt welding generally on account of its occasional tendency toward non-uniform stress distribution, for it has some peculiar virtues whereby the full tensile or bending resistance of a member may be developed at many joints where fillet welds or slot welds (which are in effect double fillets) cannot possibly be made to serve the same purpose. Butt welds are also much more compact than others and afford a more direct and concentric transfer of stress than is generally possible with fillets. Further, butt welds save the material otherwise required for straps or gussets.

FIG. 2—WELDING A THROUGH-TRUSS RAILWAY BRIDGE
All the members are rolled sections. Note particularly the stringers continuous through the floorbeams. Also note the 40-lb. tee rails welded to each side of end post to increase the radius of gyration.

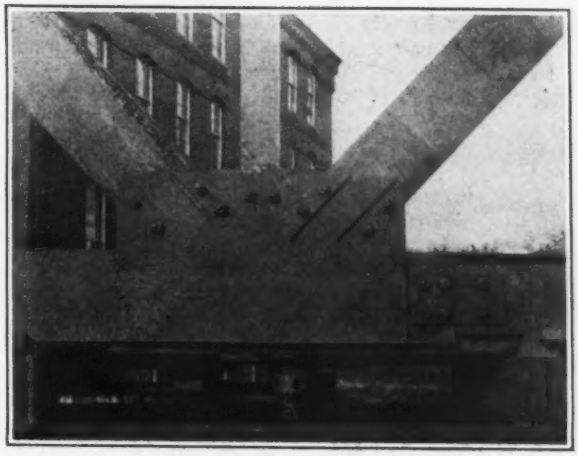


FIG. 3—A PARTLY WELDED BOTTOM-CHORD JOINT
Note the slot welds (in effect double fillet welds) which literally take the place of the rivet lines on a riveted structure.

On the other hand, butt welds generally require more careful precautions than the fillet type, since the order in which they are built up and their arrangement in the design are likely to affect the stress distribution. Butt welds more than ⅜ in. thick are built up in successive layers and are thereby rendered less subject to satisfactory inspection after completion; the beveling in preparation for butt welding is a considerable item of fabrication cost, and the V-shape of the weld section causes the amount of welding to vary as the square of the thickness, with resultant loss of economy in case of thick welds. In compression butt welds, technique is less important, and cost comparisons with fillet welds are more favorable than for tension welds on account of higher allowable unit stress.

Criticism of Design—The writer's present views, which are of course tentative, on the question of suitability and economy of various features of the Chicopee Falls bridge, are to the effect that it would have been more economical and quicker to use plates and shear welds without butt welding for all chord splices and main intersections; that the slot welds were a successful innovation and very satisfactory, and that the continuity of floor stringers is an excellent feature which prevents motion at the connections and thereby tends to longevity.

This first arc-welded bridge has been placed in service without any pronounced difficulties or delays and in addition has saved a substantial part of the cost of a riveted equivalent. On the other hand, in designing future arc-welded bridges, all of the details of this first design should not be repeated.

An arc-welding inspector will make periodical inspections of the welds to determine whether in this class of service they are in any way less satisfactory than good arc-welds have proved to be in locomotive fireboxes, ship hulls and other places where they have been been used successfully under conditions of severe vibration and shock. Inspection will also be made by the Boston &

Maine Railroad under B. W. Guppy, engineer of structures, who has co-operated in making possible this practical trial of all-welded construction in railroad bridge service.

Welding Data—In the accompanying table are given some of the welding quantities. These quantities are as calculated from the drawings, the amount of weld metal actually deposited being, of course, considerably greater because the theoretical dimensions of the welds were the minimum allowable. Welding hours are the total paid hours of work, including all lost time from whatever causes. Helpers were not provided for the welders, and welding time therefore includes climbing, moving scaffolds, cleaning surfaces and tending machines. There were two operators, each using a Westinghouse single-operator portable motor-generator welding set of

WELDING QUANTITIES, CHICOPEE FALLS BRIDGE

Item	Shop	Field	Shop and Field
⅜-in. fillet welds	308 lin.ft.	562 lin.ft.	870 lin.ft.
Butt and slot welds	88 cu.in.	450 cu.in.	538 cu.in.
All welds combined	348 cu.in.	921 cu.in.	1269 cu.in.
Hours welding labor	132½ hours	501¾ hours	634¼ hours

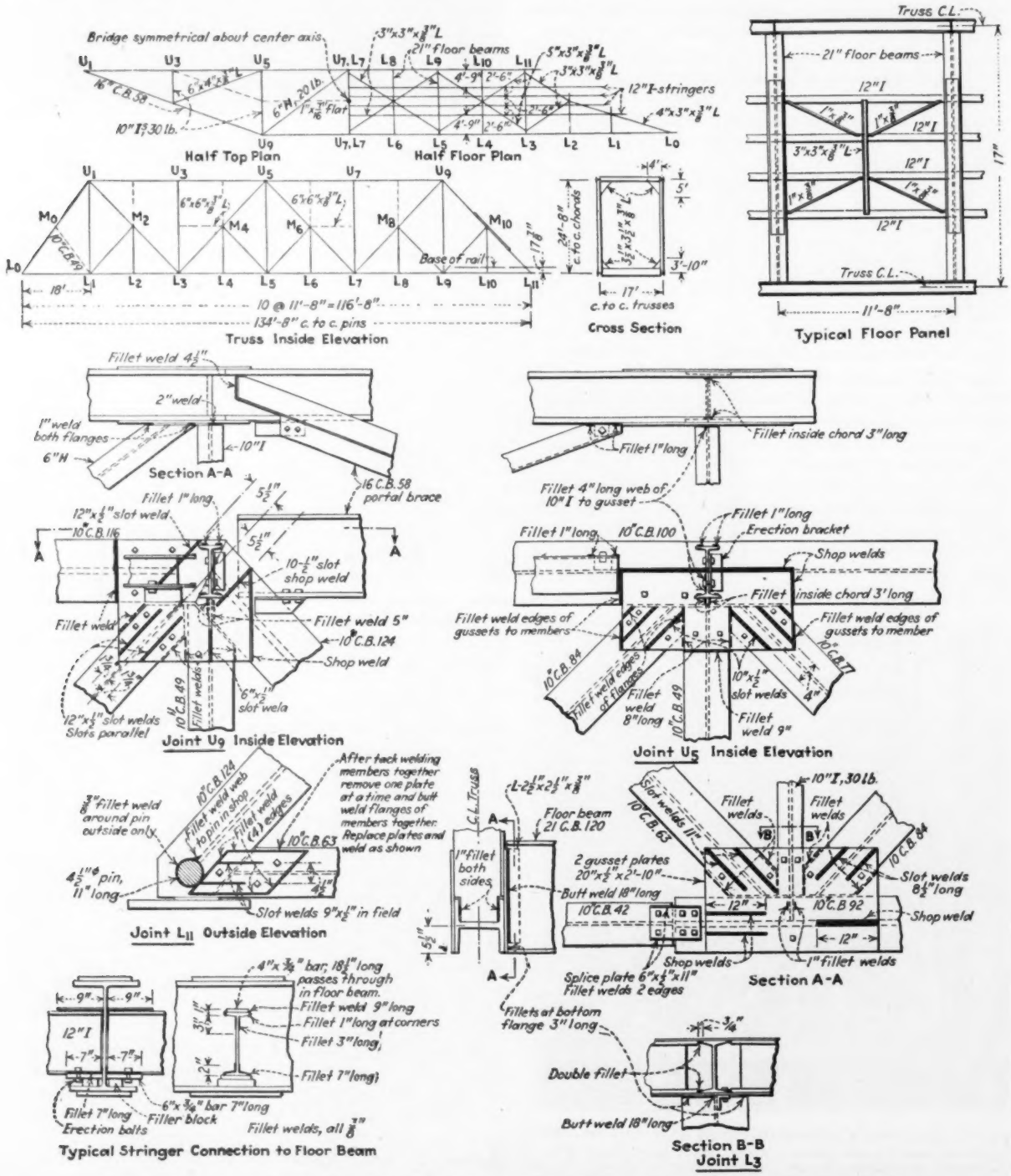


FIG. 4—DETAILS OF ARC-WELDED THROUGH-TRUSS RAILWAY BRIDGE, CHICOPEE FALLS, MASS.

200-amp. rating. The welding electrodes were mild steel bare wire, $\frac{5}{32}$ in. and $\frac{3}{16}$ in. in diameter.

The contracts for the Chicopee bridge were let for the Westinghouse Electric & Manufacturing Company by A. B. Reynders, works manager, to the Palmer Steel Company, which fabricated the steel, and to Tarbell & Leete, Inc., which erected it. Welding was performed by William Norberg and Edward Cook. The writer was consulting engineer.

Rail-and-River Terminal Built at Minneapolis

A MUNICIPAL rail-and-river terminal built and owned by the city of Minneapolis, Minn., and put in service in August, 1927, is one of the latest additions to the several new terminals of this class on the Mississippi River. It is of the wharf type in design, since its location is above the first dam and lock on the river, so that a practically constant water level is maintained. However, a wharf boat is provided to serve barges handling package freight, while barges with bulk freight can lie alongside a part of the wharf having railway tracks and a locomotive crane. A winter view is given in Fig. 1, with a typical cross-section in Fig. 2 and a layout plan in Fig. 3.

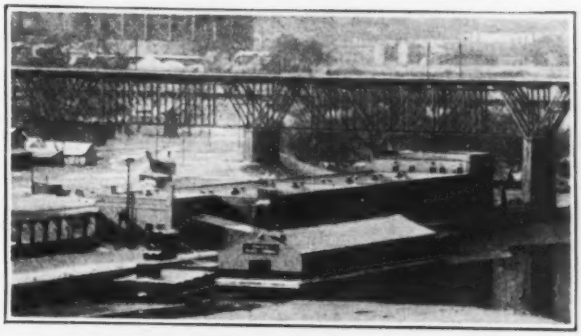


FIG. 1—WATERFRONT TERMINAL AT MINNEAPOLIS

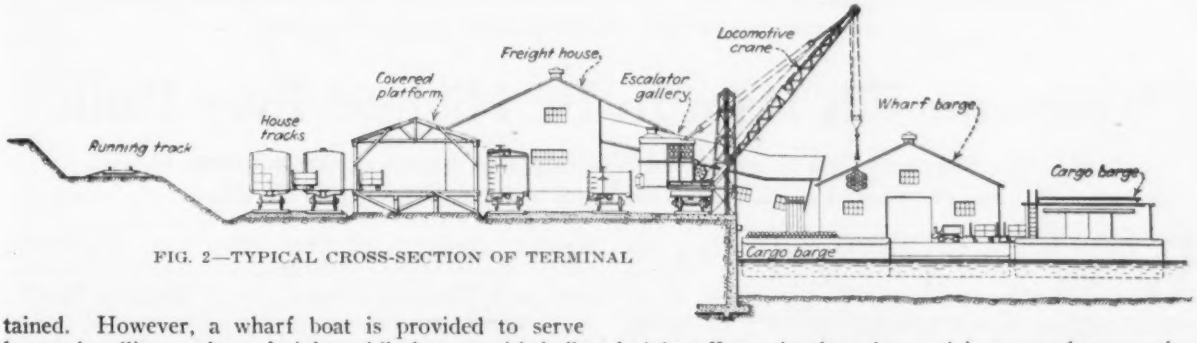


FIG. 2—TYPICAL CROSS-SECTION OF TERMINAL

The site of the terminal is just below the Washington Ave. bridge, where the city owns 1,500 ft. of waterfront having a minimum depth of water of 6 to 8 ft., while the loaded barges of 250-ton capacity have a draft of about 4½ ft. From the Minneapolis freight yards a stub or dead-end spur track is extended to the riverfront, and five tracks lead from this spur into the terminal. Two tracks are at the rear of the dock house or freight house, and two are near the front of the wharf, while the other serves a covered platform. The face of the wharf is formed by a reinforced-concrete wall of the counterfort type.

A one-story dock house, 60x400 ft., of brick and tile construction, with flat roof, serves for handling and storing freight. At one end of this building is the city freight office. At the other end is an escalator, or inclined conveyor, for handling package freight between the wharf boat and freight house. Tractors and trailers are also provided for this service. The wharf boat, 45x214 ft., is kept with its deck at the same level as the cargo barges by means of water ballast. A 15-ton locomotive crane provides for the loading and unloading of bulk freight.

The design and construction of this water-port terminal was under the direction of N. W. Elsberg, city engineer of Minneapolis, with Walter F. Schulz, Memphis, Tenn., as consulting engineer. The total investment cost for construction and equipment, exclusive of land, was about $400,000.

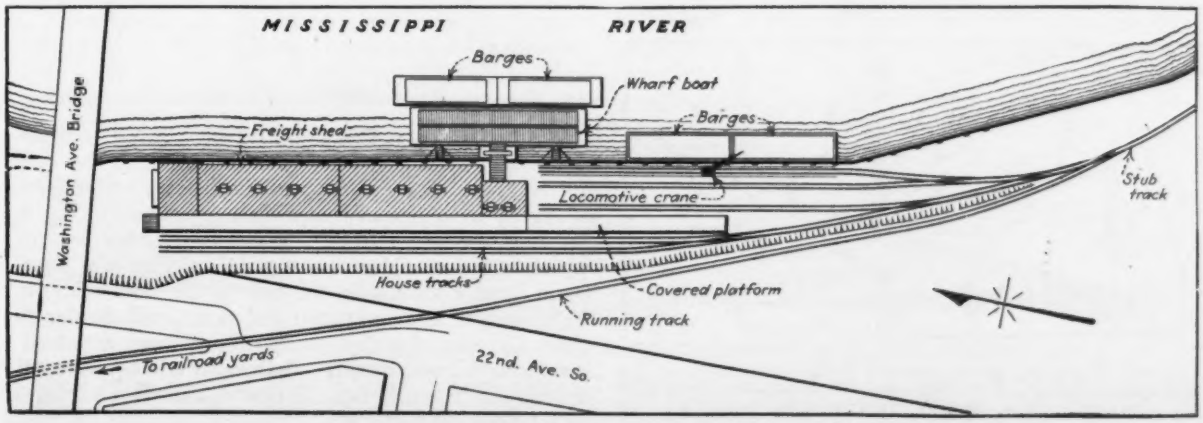
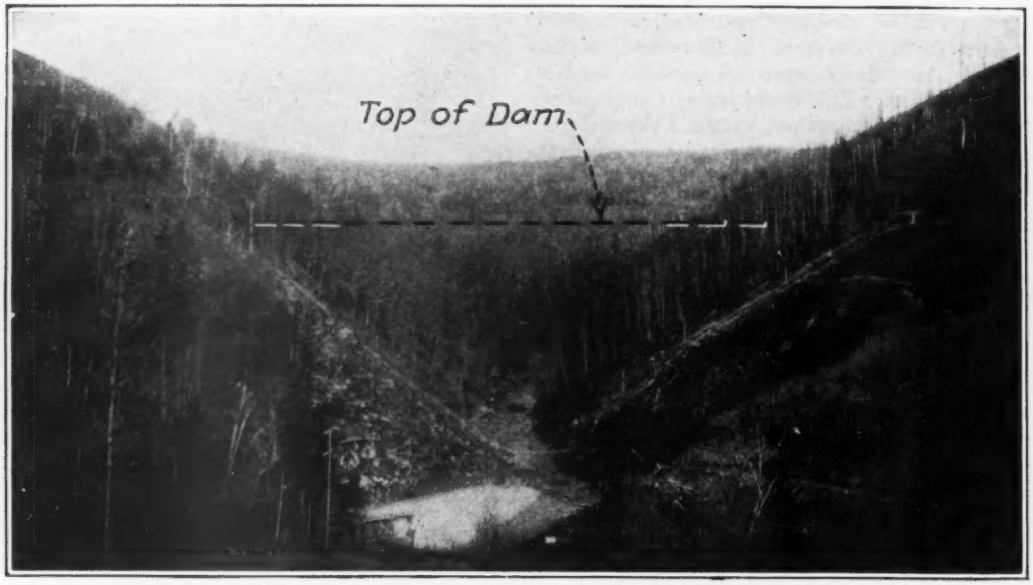


FIG. 3—PLAN OF MUNICIPAL TERMINAL



COBBLE MOUNTAIN DAM SITE ON LITTLE RIVER, MASSACHUSETTS

Hydraulic-Fill Dam to Be Highest Ever Built

New Cobble Mountain Dam of Springfield Water Supply System in Massachusetts to Rise 245 Ft. Above Foundations With Total Volume of 1,800,000 Cu.Yd.

WITH its bulk of 1,800,000 cu.yd. rising to the record height of 245 ft. above bed rock, the new Cobble Mountain dam of the Springfield, Mass., water supply system will take a prominent place among the great dams of the world. It will be the highest earth dam ever constructed, as shown in Table I. The Dix River dam of rock fill construction, 275 ft. high, cannot properly be classed as an earth dam. The unique location in a narrow gorge turning 90 deg. within the limits of the dam, a crest length of only 700 ft., and a width or thickness of 1,505 ft. toe to toe make the Cobble Mountain structure assume the aspect of a plug in the canyon rather than a conventional dam.

The dam is part of the additional water supply development on Little River, above the existing supply system. The completed development will consist of: (1) The dam, of earth with concrete cut-off walls and toe wall, with the existing rock-filled timber crib diversion dam forming the upper toe of the hydraulic fill, impounding a reservoir of 22 billion gallons (with 7 ft. spillway flash boards) covering 1,120 acres, which is to be cleared; (2) a separate spillway 800 ft. long, spanned by a concrete arch highway bridge; (3) a diversion tunnel, 1,600 ft. long, recently constructed, to be used to divert the river around the dam during construction, and later to be used as a permanent controlled outlet; and (4) an outlet tunnel, 7,105 ft. long, furnishing a 450-ft. static head to a power plant in the Little River gorge.

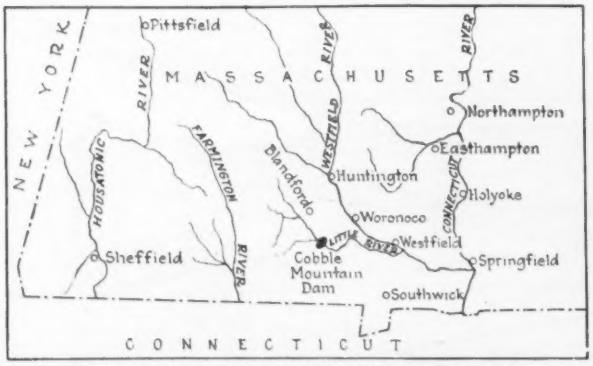


FIG. 2—MAP SHOWING LOCATION OF COBBLE MOUNTAIN DAM

Design of Dam—The dam with various sections of construction is shown in cross section in Fig. 4, and in plan in Fig. 5. Comparative elevations of various parts of the project are shown in Table II. A clay puddle core will be deposited under a central pool, using extreme care to make it impervious. The top width of this core will be from 15 to 40 ft., and the bottom width from 120 to 210 ft. Allowable slope limits are shown in Fig. 4. Flanking the central core will be shoulder sections of consolidated material of various sizes sluiced into place. These shoulders comprise the bulk of the dam. Outside the shoulders, both upstream and down, will be dumps where all material is first deposited and some unconsolidated material will remain. Both faces will be protected by layers of heavy riprap. Estimated classified yardages are tabulated in Table III.

TABLE I—HEIGHTS OF VARIOUS EARTH DAMS

Dam	Spillway height above Stream bed, ft.	Total height above Stream bed, ft.
Cobble Mountain	215	245
Tieton (Wash.)	211	232
Calaveras (Calif.)	185	220
Saluda River	200	208
Davis Bridge (Vt.)	185	200
Necaxa (Mexico)	164	192
San Pablo	135	165
Goose Creek	137	150
Paddy Creek (N. C.)	120	130
Gatun (Panama)	78	120
Dix River (rock fill)	245	275

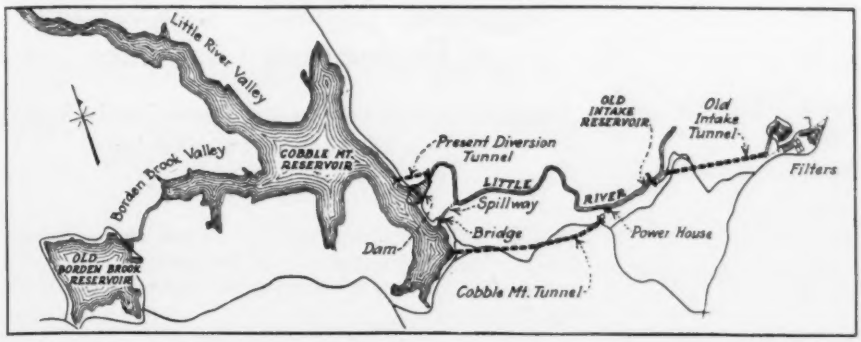


FIG. 3—MAP SHOWING RELATION OF NEW AND EXISTING PROJECTS, SPRINGFIELD WATER SUPPLY SYSTEM

None of the three outlets go through, under or over the fill, eliminating a source of weakness in many earth dams. Fig. 3 shows the existing and proposed projects.

Before the sluicing is begun, the central core section will be stripped to bedrock, and two concrete cut-off walls will be constructed. One of these walls will be extended up the side slopes as the fill rises. A heavy concrete retaining wall will be built at the lower toe, and from the stripped section to this wall a rock-fill wedge will be placed to retain the material at the early stages of sluicing (Fig. 4).

Dam Construction—Part of the fine material will be obtained from washing down the side slopes, the remainder coming from the fines sluiced out of the dumps. Suitable material for the entire fill has been found in the Borden Brook and Pebble Brook valleys, about a mile from the dam site. The material will be hauled to the site and sluiced into place from dissolving boxes, or placed by the semi-hydraulic method of dumping dry at the outer edges and washing into place. The method to be used is at the contractor's option. The water from the central pool will be used over and over, replenished from Little River when necessary.

TABLE II—ELEVATIONS OF IMPORTANT PARTS OF PROJECT

Description	Elevation, Ft.
Top of dam	965
Spillway flashboards	952
Spillway normal crest	945
Bedrock at central core	720
Top of concrete toe wall	755
Top of diversion dam	810
Intake diversion tunnel	754
Intake new power tunnel	830
Top of penstock	780
Power house	492

New Tunnel and Spillway—The new outlet tunnel to the power house will be of horseshoe section, as shown in Fig. 7, over 7,000 ft. long, concrete lined throughout, except for 500 ft. at the lower end which will be lined with 10-ft. steel pipe. The proposed capacity will be 950 sec.-ft. Control works will be located in a shaft 125 ft. deep and 215 ft. from the upper portal. Construction of the penstock, surge chamber and power house will begin later, but will be completed along with the remainder of the project.

The open-cut spillway, 800 ft. long, will have a capacity of 20,000 sec.ft. and, except for the crest wall, will be unlined. With a wide intake at the crest, the cut is designed with a combined drop and narrowing section to convert as much as possible of the available head into velocity. That the design will work satisfactorily is indicated by a small model built to scale across a spring outlet. The use of flashboards on the crest will raise the water level 7 ft.

TABLE III—SUMMARY OF QUANTITIES IN DAM

Description	Cubic Yards
Dry stripping	10,000
Rock excavation for cut-off trench and toe wall	7,000
Hydraulic stripping (side slopes)	83,000
Remainder of hydraulic fill	1,500,000
Total hydraulic fill	1,600,000
Concrete in cut-off walls and toe wall	4,000
Rock fill	146,000
Rock fill previously placed in diversion dam	50,000
Total volume of dam	1,800,000

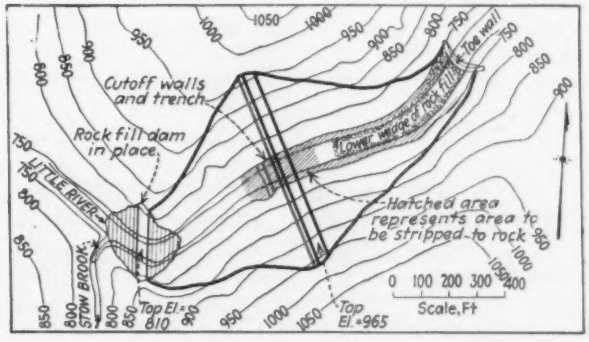


FIG. 5—PLAN OF DAM

October 1, 1930, has been set as the completion date for all work. The new development is being done under the direction of the Board of Water Commissioners of

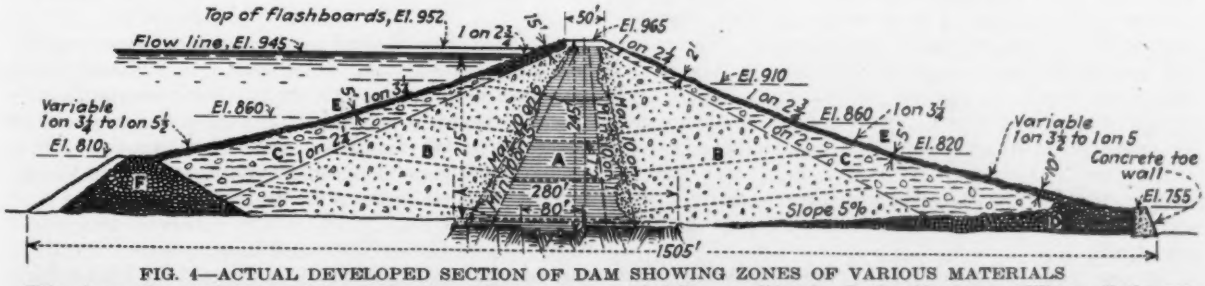


FIG. 4—ACTUAL DEVELOPED SECTION OF DAM SHOWING ZONES OF VARIOUS MATERIALS

This shows the maximum section of the dam following the curvature of the river and is 160 ft. wider than the standard section used in design. The following legend applies to the above cut: A—Core—Clay puddle deposited under central pool. Effective size approximately 0.01 mm; B—Shoulders—Sand, gravel, rock and boulders, deposited from running water on slopes and fully consolidated; C—Outside dumps—Where all the material is first deposited and from which most of it is sluiced but some remains not fully consolidated; D—Lower wedge of rock fill. To be deposited dry before sluicing starts; E—Rock fill on face. Broken mica schist or boulders; F—Rock fill cofferdam. Previously built.

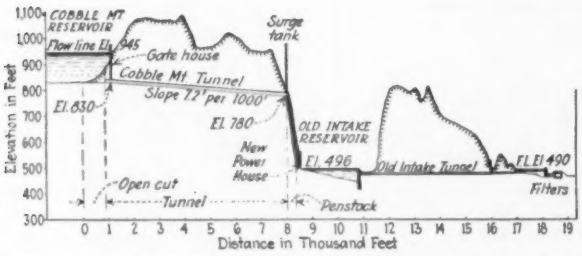


FIG. 6—PROFILE OF NEW COBBLE MOUNTAIN TUNNEL AND EXISTING WORKS

Springfield. Elbert E. Lochridge is chief engineer and H. H. Hatch is resident engineer for the board. Hazen & Whipple, New York, are consulting engineers. The

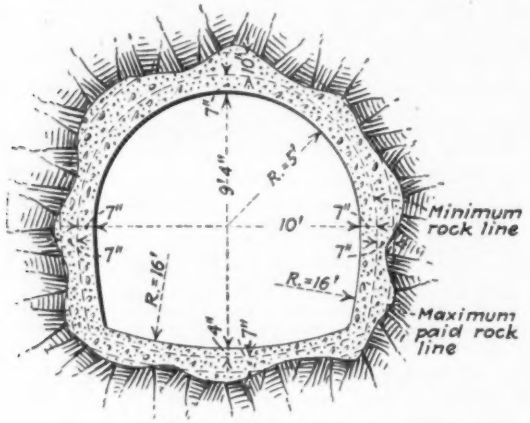


FIG. 7—CROSS SECTION OF NEW TUNNEL

contractors on the dam, spillway, bridge and clearing are Winston & Company, Inc., Kingston, N. Y., and on the tunnel the Frazier-Davis Construction Company, St. Louis.

Court Refuses Damages in Water Supply Suit

In a lawsuit for damages from the city of Dover, N. H., on account of alleged "toxic gastritis," impaired health and reduced earning capacity, from drinking two glasses of water from the city's system, the jury in the Stratford County Court rendered a verdict in favor of the city.

The water supply of Dover, according to an account of the lawsuit published in the March issue of *Health* (New Hampshire Board of Health, Concord, N. H.), is taken from springs, aerated, passed through slow sand filters and chlorinated. The plaintiff, a young woman, resided in one of three houses supplied "through comparatively long lengths of service pipe." The plaintiff "noticed nothing wrong with the odor or taste of the water and was not conscious of having swallowed any foreign matter, yet shortly thereafter her mother noted the development of an odor and a considerable sediment in the water drawn from the faucet, and it was claimed that on the following morning a worm, carefully preserved and exhibited at the trial, was ejected from the pipe."

No one else claimed to have been made ill. An analysis of water from the faucet in question "indicated organically and bacterially excellent water, with freedom from torpidity and sediment but with some odor."

Suggestions Made for Employment of Engineering Graduates

Industrial Conference at the Pennsylvania State College Hears Report Containing Definite Recommendations

A COMMITTEE report to the Industrial Conference at Pennsylvania State College contains a number of recommendations upon the ethics of employing engineering graduates.

General Suggestions

(1) Both the educator and the employer should consider as of first importance the interest of the student as a prospective citizen and as a prospective member of the engineering profession. (2) Every effort should be made to develop that understanding between the engineering schools and industries which is necessary for intelligent co-operation.

Suggestions to the Employer

(1) Should furnish full and not too optimistic information regarding working conditions, opportunities and rate of advancement. (2) Should select only the number of graduates required according to a careful estimate of conditions. (3) Should allow student reasonable time after employment opportunities are presented to become familiar with other opportunities before making a decision. (4) Should act promptly on all applications. (5) Should secure the consent of the student to any contemplated change in the employment agreement. (6) Should not employ a student known to have entered into an employment agreement with another, unless consent of other has been obtained by student. (7) Should avoid prejudicing student against the opportunities afforded by other companies. (8) Should provide opportunities which will enable each graduate to develop his latent possibilities to his own advantage as well as to the advantage of his company and of society.

Suggestions for the School

(1) Should not accept fees for continued instruction of students who obviously will not later qualify for engineering work. (2) Should supply unbiased information and advice regarding the various opportunities for employment. (3) Should not hamper the student in his freedom of choice in employment. (4) Should not refer employment possibilities to the employed graduate, except upon his application, nor attempt to separate the graduate from his employment without first having taken the matter up with his employer.

Suggestions for the Graduate

(1) Should supply full and correct information regarding his experience and background. (2) Should accept only one position at a time. (3) Should secure the consent of the employer before changing the employment agreement. (4) Should not accept training in a special training course, with the intention of using it in the interest of another, without the consent of the employer.

Members of the committee who submitted this report were: C. S. Coler, chairman, Westinghouse Electric & Manufacturing Company; H. L. Donaldson, Philadelphia Company; E. W. Kempton, American Steel & Wire Company; R. R. Weaver, Western Electric Company; and A. J. Wood, Pennsylvania State College.

Designing Reinforced Concrete Against Bending and Compression

Method of Designing Beams and Columns Permits Direct Calculation of Steel Without Preliminary Computations

By C. L. Christensen
With McClellan and Junkersfeld, New York City

THE SUBJECT of designing concrete beams, walls and columns for both bending and direct compression is one that causes some uneasiness. Ordinarily it is done by first assuming or roughly computing a section, and then checking it by means of a third-degree equation, or by curves and tables. This indirect method is unnecessary, and there is presented here a direct method which is believed to be both simple and usable.

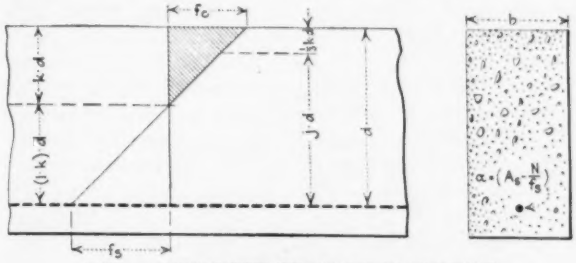


FIG. 1—CONCRETE BEAM WITH TENSILE REINFORCEMENT

Reinforced-concrete members subject to both bending and direct compression will be considered, first with reinforcement on the tension side only and second with reinforcement at both faces.

Reinforcement on Tension Side Only—In demonstrating that it is possible to make a direct computation of the depth d and the tensile steel area α for given steel and concrete stresses, it is first necessary to compute the moment M around the center of the tensile reinforcement caused by all forces at right angles to the axis of the member and all forces parallel to the axis of the member, Fig. 1. The transverse forces may be designated by P and the longitudinal forces by N. Next, by the use of the formulas ordinarily used for bending such as

$$K=\frac{nf_c}{nf_c+f_s},\ n=\frac{E_s}{E_c},\ A_s=\frac{M}{jdf_s}\text{ and }d=\sqrt{\frac{2M}{kjbf_c}}$$

there is computed the depth d and the tensile steel area A_s needed to resist the bending moment M only, with specified unit stresses of f_c and f_s.

When the moment M is taken around the center of the tensile reinforcement, then the direct compression N has been transferred to and must be applied at this point. The resulting steel area is, therefore, obtained by subtracting an area N/f_s from A_s. Hence the tensile steel area $\alpha = A_s - N/f_s$ and the design for bending and direct compression is made just as easily as a design for bending only.

Reinforcement at Both Faces—If the depth d is fixed by the available clearance, it may also be necessary to use reinforcement on the compression side. In this case there is first determined the moment m which can be resisted by a beam with a depth d and tensile steel area $A_1 = \frac{kdbf_c}{2f_s}$. To resist the remainder of the moment M (as above defined as caused by all forces at right angles to the axis of the member and all forces parallel to the axis of the member) additional steel areas are added at the centers of tension and compression. This additional tensile reinforcement $= A_2 = A_1\frac{(M-m)}{m}$, and the resulting tensile steel area is

$$A_1 + A_2 - \left(\frac{N}{f_s}\right) = A_s - \frac{N}{f_s}$$

To locate the compression steel at the center of the compression in the concrete, Fig. 2, is a theoretical expedient which gives a distance from the compression face consistent with practical placing of the bars. By this means we find the area of the steel on the compression side to be

$$\beta = \frac{A_2 f_s}{\frac{2}{3}f_c}$$

Another expression for β is formulated as follows: As the depth d is given, the problem is to determine the width of concrete needed to resist M. The difference

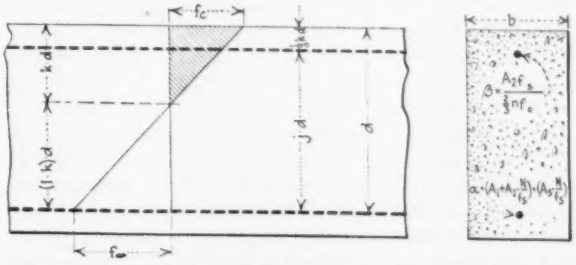


FIG. 2—CONCRETE BEAM REINFORCED FOR BOTH TENSION AND COMPRESSION

between the width needed and the width given $= b\left(\frac{M-m}{m}\right)$, and must be taken care of by the addition of the compression steel. Therefore, $\beta\ (\frac{2}{3}nf_c) = \frac{1}{2}kdbf_c\left(\frac{M-m}{m}\right)$ and $\beta = \left(\frac{3kdb}{4n}\right)\left(\frac{M-m}{m}\right)$. This expression can easily be transformed into the above-given expression for β.

This general principle and method holds good also when the compression steel is not located at the center of the compression in the concrete, but the formulas become then slightly more complicated.

Factor of Safety—If M/N remains constant for a temporary excess load, the position of the neutral axis also remains unchanged, and the factor of safety is the same as for bending without direct compression. However, if the transverse forces P are increased while N, the longitudinal forces, remain constant, the tensile steel may be overstressed. It is necessary to guard against this by modifying the design so that the section is calculated for N and about $1.5\,M$; the latter can be accomplished by using unit stresses of $1.5f_s$ and $1.5f_c$. By this method there is secured the same value for d as before, but α is increased to $\left(A_s - \frac{N}{1.5f_s}\right)$. This

applies when both faces are reinforced as well as for tensile reinforcement only.

It is particularly in structures where the traverse forces are independent of the direct compressive forces that this must be considered, as for instance in tunnel walls and abutments exposed to varying intensities of earth pressure. Wall columns in buildings are in this respect different, because the bending moment due to continuity of column and floorbeams is mainly dependent on the vertical floor load. Furthermore, building columns are as a rule heavily reinforced.

Conserving Water Supply at Springfield, Mo.

Keying Up Water Service Reduces Pumpage and Operating Expenses in Face of Rapidly Increasing Population

By William J. Gray

Superintendent and Engineer, Springfield City Water Company, Springfield, Mo.

REDUCING pumpage and operating expenses while increasing the net revenue, although taking care of about 3,000 additional services, both domestic and industrial, has been accomplished by the Springfield City Water Company, of Springfield, Mo., during the past four years. Meanwhile large additions to the supply and other extensions to the works have been made.

The demand for more water became alarming in 1924. Extended surveys and analyses were made of all possible sources, but final recommendations were not reached until 1926. In view of the threatened shortage of water it was a paramount necessity to check waste and insure the economical use of water while these surveys were in progress, as it would be at least two years before supplies could be added. In the accompanying table are given the records of pumpage, operating expenses, income, population services and distribution system for the five years 1923 to 1927, showing the effective results of the campaign for pumpage reduction. The increase of pumpage in 1927 is attributed to industrial consumption, as a number of new and large creameries were established, whose demand is reflected in the daily per capita consumption.

Economic Operating Results—In four years the daily per capita consumption was reduced from 77 gal. to the low figure of 58 gal., a reduction of about 1,000,000 gal. in the daily pumpage. During this period the income was steadily increased almost 20 per cent, while the operating expenses were correspondingly reduced in the same percentage. Meanwhile the distribution system was rapidly extended, as the table shows.

The methods followed in bringing about these results included a thorough investigation of each department. The first essential was good foremen. They had to be educated to appreciate their work; also they had to be loyal and men of good character. Poor workmen in labor crews show clearly the lack of proper foremen. Co-operation and assistance for the operations at the filtration and pumping stations were also obtained. It was found that to obtain efficient service the superintendent must show appreciation for good work, stand ready to accept suggestions and give the workmen a "square deal."

While a better morale was being established the meter department was thoroughly overhauled. Practically every meter in the system was removed, tested and repaired. Records of tests, age and repairs of each meter were installed. Prescribed tests and regulations governing the meter department were gradually established. All this work was finally woven into the routine work of the department. Its effect has been exceptionally good. The usual run of incoming meters give an efficiency test in excess of 90 per cent. This work brought to light considerable leakage in services and mains. The major result accomplished shows that the water sold through meters reached the high level of 76.3 per cent in 1926, an increase from 53.1 per cent in four years. Careful surveys were made on the distribution system, including tests of the Venturi meter, continuous inspection on the transmission mains, and a stoppage of leakage at the pumping station. This leakage had evidently been active for some time, but had not been considered serious enough to mention to the superintendent.

WATER-SAVING CAMPAIGN AT SPRINGFIELD, MO.

	1923	1924	1925	1926	1927
Daily per capita consumption, gal.	77	76	71	57	*62
Yearly pumpage, m.g.	1,490	1,546	1,566	1,298	1,472
Total operating expense	$78,052	$68,049	$69,862	$63,206	$64,967
Percentage of water sold through meters	53.1	56.6	67.5	76.3	69.7
Net income revenue	$250,418	$263,102	$273,285	$292,273	$306,512
Population	53,000	56,000	60,000	62,000	65,000
Number of services	11,608	12,504	13,173	14,033	14,681
Miles of mains	134.32	148.36	176.48	187.70	199.39

*Increase attributed to new industrial plants.

Water Supply and Improvements—The present supply is taken from five springs, which yield an average of 10 m.g.d., except during the dry summer periods. The flow from three of these springs discharges into a 125-m.g. reservoir. In addition to the springs there are three deep wells (1,450 ft.) having a combined capacity of 3 m.g.d. On one of these wells, lowering the bowls to a depth of 100 ft. and inserting an additional bowl brought the capacity of the well to 2¼ m.g.d. It is estimated that it will maintain this capacity for 30 to 45 days of continuous operation. This well is used only occasionally. It is held mostly for operation during hot weather when the spring and other well supplies are reduced.

Three separate steam and electric plants, located at the various springs, deliver water to the filters and main pumping station, located 3 miles from Springfield, in a picturesque valley of the Ozarks. The precipitation works include a sedimentation basin, 8-m.g.d. filter, chlorinators and a clear well. The main pumping station is equipped with both steam- and electric-driven pumps, of 600 and 800 hp. respectively. A 10-m.g. reservoir at this station affords a reserve supply in case of breakdown at the well stations. A 14- and an 18-in. force main lead to a 16-in. belt line around the whole city, which connects with two 0.75-m.g. water towers located in the north and south parts of the city. The south water tower was completed in September, 1927.

There is now being constructed a 1,250-m.g. impounding reservoir on the North Sac River, formed by a gravity type concrete dam, 45 ft. high and 1,200 ft. long. It is now about 30 per cent completed. The cost of this work, including incidental improvements at the site, will be about $500,000. The work is being done by the Burnip Construction Company, Columbus, Ohio, under the supervision of the writer.

Building an Offshore Lighthouse in Lake Huron

Crib and Concrete Base Carries Steel-Frame Structure for Living Quarters and Lamp —Construction Methods

By Irving L. Gill
Lighthouse Engineer, 11th U. S. Lighthouse District, Detroit, Mich.

BY THE construction of a lighthouse to replace a lightship at the Martin Reef, in Lake Huron, the U. S. Lighthouse Service has effected a large saving in annual maintenance expense, and has established a fixed aid to navigation which is not subject to displacement by storms and which is serviceable in early spring and late fall when it is impracticable to maintain a lightship on the station. The lightship which formerly marked the reef was needed urgently elsewhere, and the cost of the lighthouse was much less than that of a new lightship. This station serves for the guidance and protection of lake commerce amounting to some 10,000,000 tons annually, largely in iron ore.

FIG. 1—MARTIN REEF LIGHTHOUSE, LAKE HURON

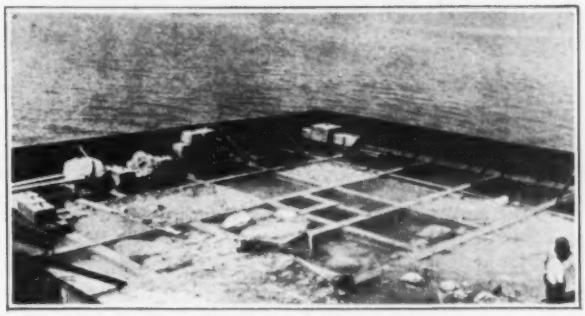


FIG. 3—SINKING THE CRIB
Note steel plating extending above crib to protect concrete from ice.

The Martin Reef lighthouse, at the northern end of Lake Huron, is located in 6 ft. of water over a dangerous reef composed of boulders overlying hard pan. The tower, 25 ft. square and over 70 ft. high, is founded on a heavy concrete pier, the top or deck of which is 18 ft. above water and 64 ft. square in plan. This pier is supported by a timber crib, filled with concrete and stone, which constitutes the underwater portion of the structure, since sound timbers under fresh water are practically immune from decay and deterioration. The completed lighthouse is shown in Fig. 1.

The site, eight miles from shore, was surveyed and the contours of the reef were determined by depth soundings. At a location effective in marking the reef for passing ships, a relatively level area in about 6 ft. of water was selected, of such kind that it was suitably protected against wave action and ice shove driven by winds over the long southerly stretch of Lake Huron.

A timber crib 60 ft. square and 5½ ft. deep Fig. 2, forms the underwater substructure. Its outer walls are built solid of 12x12-in. timbers driftbolted together, and are tied together by similar timbers framed into them by dovetails to act as both struts and ties. This interior grillage consists of five vertical tiers in each direction spaced 2 ft. apart vertically from the bottom to the top of the crib, which is below water. The crib was built in

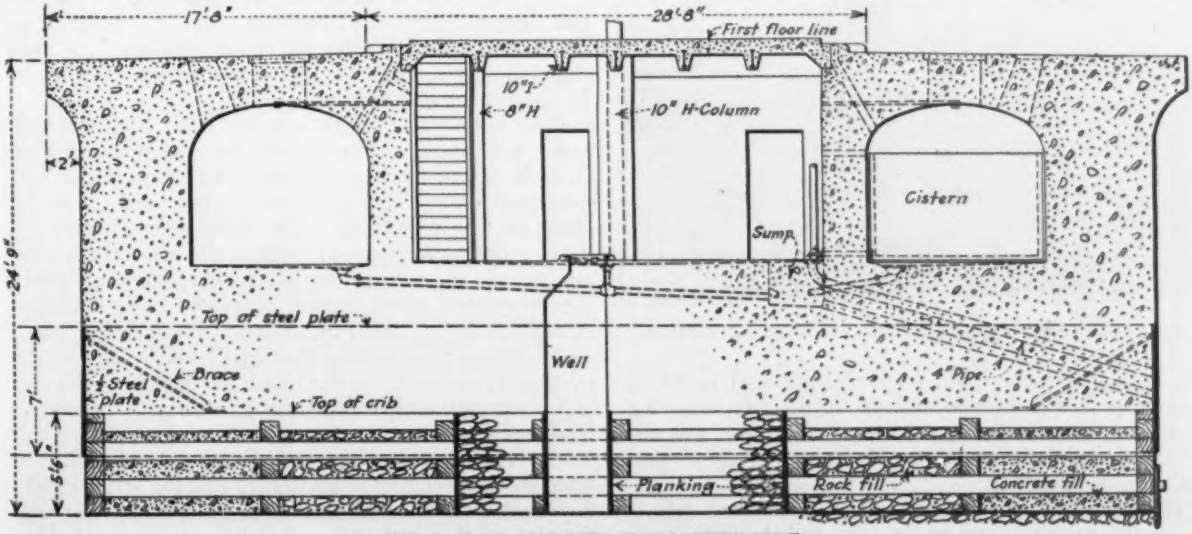


FIG. 2—CRIB AND PIER FOR LIGHTHOUSE

Scammon's Harbor adjacent to one of the Les Cheneaux Islands, about eight miles from the lighthouse site. It was built up on launching ways to a height of three courses and was then launched, being completed to the required height as a floating structure. A 7-ft. belt of ½-in. steel plate was bolted to the top timbers to form a flashing at the water line as protection against scour by moving ice and weathering of the concrete above the crib.

The completed crib, with flash plating attached, was then towed by a lighthouse steamer to the site, which had been previously leveled by means of a clamshell bucket operated from a derrick scow. Sinking the crib was accomplished by loading the top, on the corners, with stone and other ballast from the scow. Pile clusters had previously been driven off each corner of the site for anchorage purposes and for proper alignment of the crib as it was sunk onto the bottom. These piles were shod with pointed forged steel shoes in order to penetrate the hard bottom. They were driven to refusal from a floating pile driver plant, with penetration of 6 to 10 ft. The center pockets of the crib over an area of about 40 ft. square were filled with stone to secure the crib against movement, due to the heavy pounding of high seas.

A solid 9-ft. wall of concrete was then poured inside the crib, next to the outer walls, extending from the lake bottom to above water, the tremie method being employed in placing the concrete under water. Openings under the outer crib walls, where the bottom timbers rested on the uneven rock bottom, had previously been closed by short lengths of 2-in. plank spiked by divers to the outside of the crib timbers. Burlap sacking calked under the sheathing made a tight bottom joint to prevent washing of concrete. The concreting was carried on from a derrick scow carrying materials and the mixing and hoisting plant, as shown in Fig. 4. A lighthouse steamer assisted with its crew, and towed the floating construction plant between the site and the construction camp in Scammon's Harbor.

The concrete superstructure pier was then built up to

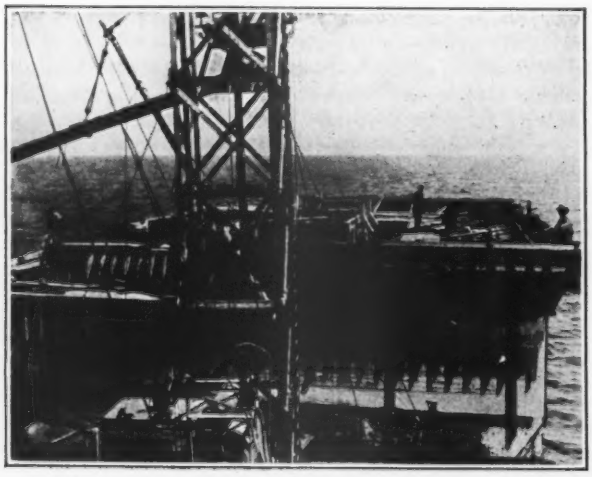


FIG. 4—BUILDING CONCRETE BASE FOR LIGHTHOUSE

18 ft. above water, with its deck increased to 64 ft. square by flaring the side walls to form a 2-ft. overhang. A cellar was provided in the center, and room was also provided under the outer pier deck for storage of coal, oil and supplies.

At this stage of the work it was considered safe to house the working crew on the pier, and the bunk house

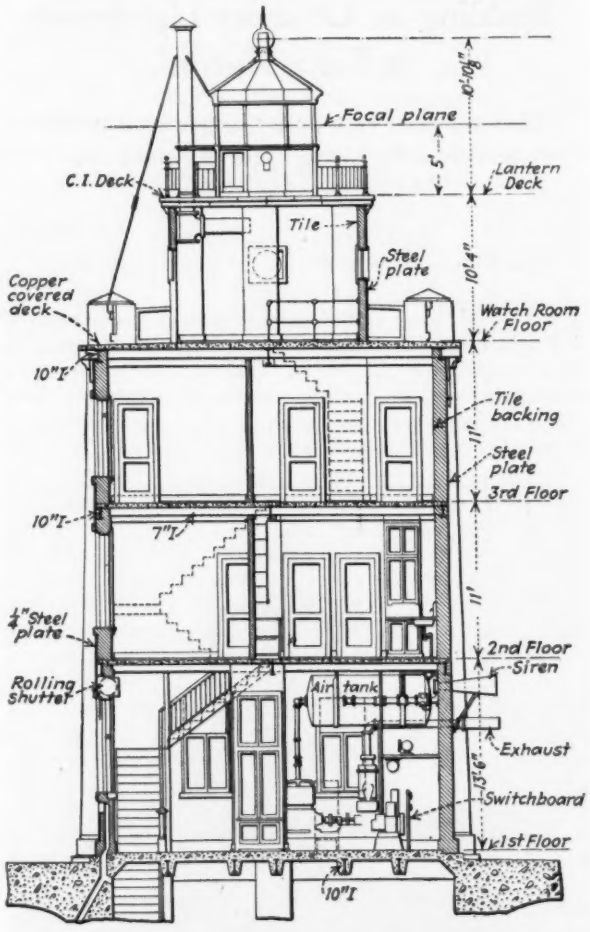


FIG. 5—MARTIN REEF LIGHTHOUSE

was therefore transferred from the camp, a kitchen and dining room being then built adjacent to it. These temporary structures were secured by carrying ⅝-in. steel cables over them and attached to the steel ladders which were anchored to the concrete. This lashing insured against the buildings being washed away during bad weather. The crew lived on the pier night and day.

Until the crew could operate from the top of the pier and independent of the lighthouse steamer, the work was handicapped during times of rough weather. At such times, however, there was generally plenty of work to be done at the shore camp.

Two 5-ton pillar cranes equipped with air hoists provided for handling supplies and the station motor-boat. In each side of the pier is a recess with iron ladder, and around the deck is a protective railing with a double chain on pipe stanchions. The lighthouse structure has living quarters for three attendants and also contains the electric and air-compressing machinery, pressure water-supply system, steam heating plant and other facilities. A well extending from the cellar to the lake bed has a 3½-in. intake pipe leading through the crib wall on the north side, its end being flush with the outside of the crib and fitted with a perforated cap as a screen. Sewage is discharged below water through a 4-in. pipe on the south side. It is considered that there is no fear of pollution, since the current flow is southward and the water supply is provided by slow infiltration in the well and through the pipe on the north side.

The lighthouse tower, 25 ft. square, with corner pilasters, is of structural steel framing, with walls of ¼-in. steel plate backed with 10-in. hollow tile plastered on the inside. Its construction is shown in Fig. 5. The floors are of reinforced concrete supported on steel I-beams and covered with battleship linoleum in the living quarters. At about 35 ft. above the pier deck is an upper or parapet deck, which is surmounted by a watch room, about 10 ft. high, carrying the lantern deck and lantern. This lantern is glazed with ¼-in. plate glass all around for a height of about 2 ft. 9 in. The illuminating apparatus, enclosed and protected by the lantern, consists of a fourth-order lens with a 300-watt electric incandescent lamp in the focus, 70 ft. above lake level. The intensity of the light is 8,000 candles and the characteristic is a group of three white flashes every 10 seconds. It is visible about 16 miles. Air compressors driven by oil engines serve a powerful reciprocating siren, which sounds for two seconds at 20-second intervals during thick or foggy weather. There is no telegraph or telephone communication with the mainland at present, but the keepers go ashore once or twice a week for mail and provisions.

This light station was built by the U. S. Lighthouse Service forces at an approximate cost of $112,000 complete, under the supervision of Charles A. Park, superintendent of the 11th Lighthouse District, with headquarters in Detroit. The executive officer of the Lighthouse Service is in Washington, D. C., under the Commissioner of Lighthouses. Each of the 19 lighthouse districts is in charge of a superintendent of lighthouses, and three of these districts are on the Great Lakes, with offices at Buffalo, N. Y., Detroit, Mich., and Milwaukee, Wis.

Street Littering at Cincinnati

That co-operation of citizens will be more effective than police regulations in checking the littering of streets with papers and trash is stated in the 1927 annual report of Fred Maag, superintendent of the department of waste collection, Cincinnati, Ohio. During the year, receptacles for such refuse were placed on street corners and served to prevent much littering. A drive was also made by the police to stop the practice of stores and others in sweeping dirt and rubbish from the sidewalks into the street, which was often done just after the city's men had cleaned the street. But it is pointed out that better results will be given by individual co-operation between the citizens and the cleaning department.

As there has been considerable trouble from itinerant scavengers, who haul papers from stores and factories and ransack rubbish cans, a permit system was installed and permits were issued only to those who have carts with lids. It was found, however, that a few of these men would then take off the tops and overload the carts, and the police were instructed to take up the permits of such offenders. Another source of annoyance is from the junk dealers, who buy the scavengers' product, as most of this is unloaded on the streets and the spill lays on the sidewalks and the streets, with the result that paper and dust are blown in all directions. Taking this class of men into court gives only temporary results. A drive was made to clean up alleys, not only for the traffic part but to eliminate indiscriminate dumping of ashes and rubbish in alleys and the corners of back yards. An ordinance requiring the use of metal cans with tight fitting lids is said to be proving effective in this respect.

New Sewage-Works for Bloomington and Normal, Illinois

Greenhouse Construction for Covering the Sludge Drying Beds a Feature of a Plant Designed to Serve a Population of 54,000

GREENHOUSE construction for covering some of the sludge drying beds is a feature of the new sewage-works for the Bloomington and Normal (Ill.) Sanitary District, dedicated on June 7, and designed to serve a population of 54,000. Sewage is carried to the plant by a 2-mile intercepting sewer of 27-in. vitrified pipe at its upper end and 36- and 51-in. vitrified segmental tile at its lower end. The sewage passes successively through bar screens and grit chambers, six Imhoff tanks, four automatic dosing tanks, two sprinkling filters and a secondary settling tank, the effluent from which goes finally through a concrete channel to Sugar Creek. The Imhoff tanks are 28x90 ft. in plan and 29½ ft. deep. The sprinkling filters have a total area of 2½ acres and are served by spray nozzles spaced 14 ft. c. to c. on 8-in. laterals. The secondary tank has revolving plows which move the sludge to a central bottom discharge pipe leading to a sump from which it is pumped to the digestion chambers of the Imhoff tanks.

There are 20 22x94-ft. sludge beds, arranged in two rows of ten on each side of an elevated concrete sludge channel. The flow in this channel is controlled by small shear gates in frames set in the concrete. To serve each pair of beds there are three of these gates, one on each side, opening onto the beds, and the third in the channel to stop and divert the flow of sludge. This channel will be cleaned by flushing after the sludge has been drawn from the tanks. The beds are separated by precast concrete slabs set in grooved concrete posts. These beds provide an area of 0.774 sq.ft. per capita for the estimated population of 1955. The first three beds on each side, at the end next to the Imhoff tanks, are covered with three bays of standard greenhouse construction, with steel frames and clear glass. This construction is 7½ ft. high at the sides and 24 ft. 2 in. at the ridges. A row of ventilating sash is provided on each side of the ridge and at the top of each vertical side. These covered sludge beds provide a drying area for use during periods of continued rainfall. At present it is expected to use the dried sludge around the plant as fertilizer for lawns and shrubbery, but it is hoped that a demand for it will be developed among farmers and florists.

The sanitary district was organized in 1925, and in May, 1926, let the contract for the works to the J. E. Simmons Company, of Bloomington, which sublet the glass covering of the sludge beds to the Lord & Burnham Company, of Chicago. Taylor & Woltmann, of Bloomington, Ill., are engineers for the district, and Stanley Pinel was resident engineer on the construction work. The trustees of the district have engaged a superintendent in direct charge of operation, assisted by three men (each on an 8-hour shift) who have charge of the pumping plant and do other work around the plant. There are also two helpers during the day, but later it may be necessary to have one or two additional men to help when sludge is being drawn. The laboratory at the sewage-works is in charge of Professor Adams, of Normal University.

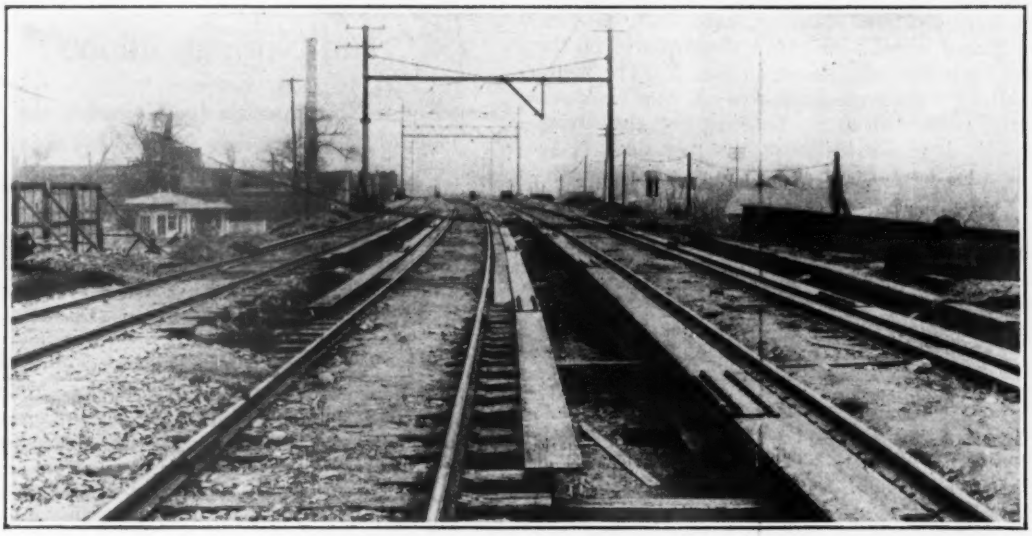


Fig. 1—Track Stringer Cradles in Place

Underpinning Railway Tracks for Subway Crossing

Three Tracks Over Skew Crossing Carried in I-Beam Cradles Supported on Radial Cross-Girders Temporarily Posted Down and Then Shifted to Columns in Pits Going to Final Subgrade

By George Paaswell

Engineer, Corson Construction Corporation, New York, N. Y.

AN EFFECTIVE plan for undercrossing a railway was worked out in building the Fourteenth St.-Eastern subway in Queens borough, New York City. Near Cooper and Wyckoff Aves. the subway crossed under the four tracks of a busy freight branch of the Long Island Railroad. Here one of the outside tracks was taken over by the contractor for use in construction, leaving three tracks with concentrated traffic to be supported while the subway was being constructed underneath. To complicate the task the crossing was on a skew on curve as indicated by Fig. 2 and the subway structure was changing from two decks south of the crossing to a one-level parallel-track structure north of the crossing. A typical transition cross-section is shown by Fig. 6. The total length of undercrossing was 200 ft., the width of subway structure was 45 ft., and the depth of excavation was 40 ft. at the lowest point of subgrade.

Constructing Track Supports—The general construction plan and methods employed on the Fourteenth St.-Eastern subway were outlined by the writer in *Engineering News-Record*, Aug. 18, 1927, p. 269. Mention was made there of the undercrossing method developed and used at two crossings. Of these the one described was the largest and developed the method to its greatest extension on the subway work. This article gives the procedure in detail.

The general plan was to pick up each track in a cradle of I-beams as shown by Fig. 3. First 6x12-in. timbers set vertically were inserted between ties. The tracks were then reballasted. When this operation was completed, 24-in. I-beams were placed in trenches along the track and just outside the ends of the ties. The beams were then jacked into place to pick up the temporary ties on the lower flanges. The beams were tied together by tie rods and were spliced for full moment and shear. As the railroad tracks are on a curve at this point, it was necessary to warp the beams into position. The railroad clearances required that no portion of the temporary work should extend more than 1 in. above the top of rail. The 6x12-in. ties therefore were set on 6x6-in. timbers resting longitudinally on the bottom flanges of the beams; this effectively dropped the cradle to within the required clearance. To add to the security of the structure the original railroad ties were also shimmed to bear on these longitudinal fillers, although the temporary ties inserted were ample to carry the loads. Fig. 1 shows the track stringers in place and two of the radial beams ready to be shoved under them.

Setting Radial Beams—Upon completion of the track cradle trenches were excavated along lines radial to the center line of the subway and on 20-ft. centers, Fig. 2. No sheeting or bracing was required, since the beam cradles carried the tracks across the trenches with an ample margin of safety. Then 30-in. I-beams were set in these trenches, rolled in by hand, and jacked up to

take the track stringers. Since the railroad tracks were superelevated due to the curve, it was necessary to place shims of varying thickness under each stringer. To reduce the handling weight of the girders they were ordered in 25- and 30-ft. lengths and were full-spliced at the center. Both the track stringers and the radial beams extended about 12 ft. beyond the net lines of the subway structure, making it possible to excavate for a depth of 7 ft. beneath the railroad tracks without additional shoring. The splice plates were ordered punched to pattern and then were used as templets for the beam holes. All splice holes in the beams were burned. The bottom flanges of the track stringers were bolted to the top flanges of the radial beams.

Working Gallery and Pits—The next step was the

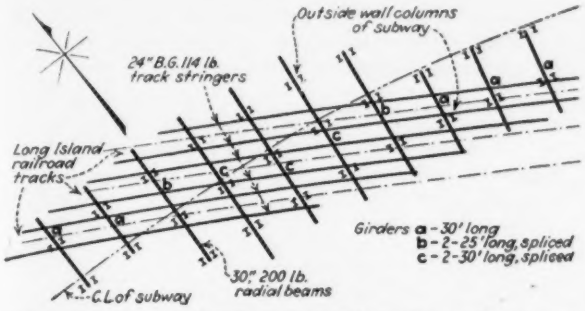

Outside wall columns of subway
24" B.G. 114 lb. track stringers
Long Island railroad tracks
Girders a - 30' long
b - 2-25' long, spliced
c - 2-30' long, spliced
30" 200 lb. radial beams
C L of subway

FIG. 2—PLAN OF TRACK STRINGERS, RADIAL BEAMS AND PERMANENT COLUMNS

excavation of a working gallery to a depth of 7 ft. over the entire crossing area. As all the steel work was fully spliced, temporary posts could be placed at any point as this excavation progressed. Fig. 4 indicates the arrangement. The material was excavated by hand, loaded into narrow-gage dump cars by belt conveyors and dumped into the subway cut at either end of the crossing. Clamshell cranes reloaded the material into

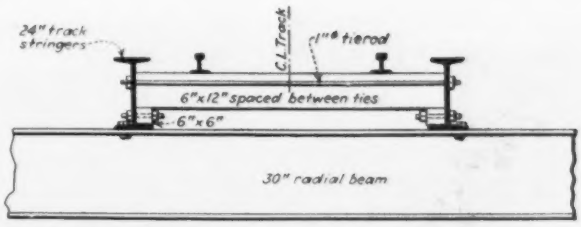


FIG. 3—I-BEAM CRADLE BUILT UNDER EACH TRACK

trucks. Upon the completion of this stage of the work the entire crossing rested on timber posts and cribbing.

Before any further general excavation could be made it was necessary to carry the supports to the subgrade of the subway structure. At 20-ft. intervals a pair of subway bents were extended upward to the bottom of the radial beams. This necessitated placing pairs of columns in pits excavated to subgrade. Since the permanent subway roof steel must later be fitted in between these columns, the survey work had to be very exact, any error in placing steel practically requiring a refabrication of the roof girders. The survey work of the Board of Transportation engineers was performed so effectively that no trouble was had in framing in the roof girders. It must be remembered that the subway center line at this crossing is a compound curve with the steel bents radial to it and it presented a very intricate problem in surveying. The pits, Fig. 5, 7x4 ft. in cross-section, ranged from 15 to 25 ft. in depth below the gallery floor. Excavation was carried on inside 2-in. box sheeting with center braces, which were later removed in placing the columns. Material was removed from the pits in buckets handled by a small air hoist controlling several pits at a time. It is interesting to note that although the heavily loaded temporary posts were set sometimes as close as 1 ft. to the pits, the lateral effect of such loading on the sheeting was inappreciable. The soil was a compact glacial drift, moderately moist

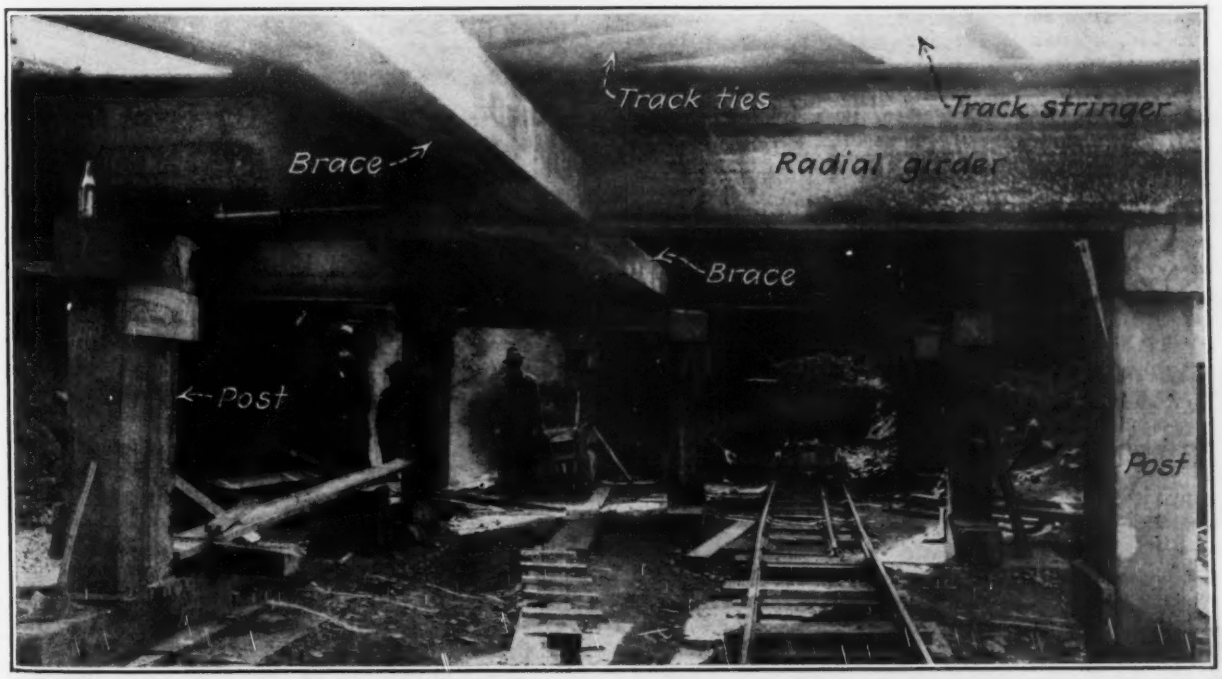


FIG. 4—POSTS CARRY TRACKS DURING FIRST CUT

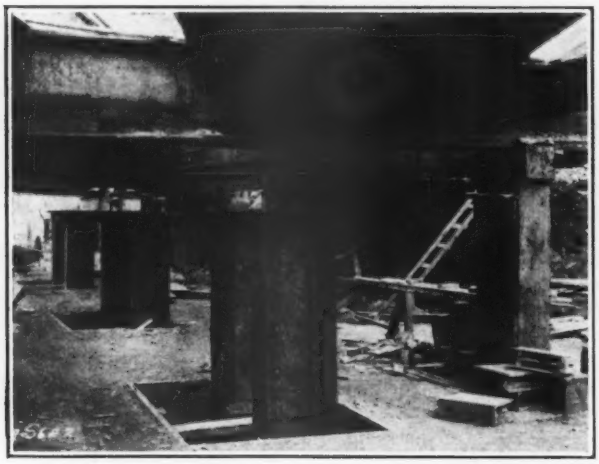


FIG. 5—STEEL COLUMNS IN PITS READY TO TAKE LOAD

and had to be broken up with clay spades. There was just a sprinkling of boulders in the soil. When subgrade was reached a 6-in. slab of concrete was placed, reinforced with 1-in. square bars.

Setting Steel Columns—To facilitate erection the center line and east side columns were ordered spliced; the west columns were delivered in one piece. The spliced members were about 18 ft. long, the east columns were from 20 to 24 ft. The columns were lowered into place with block and fall attached to the overhead beams. After the columns had been dropped into the pits the engineers carefully resurveyed the lines, after which the columns were plumbed and braced to the sides of the pits, and sufficient concrete was poured to fix the bases. An inside form was then framed and the remainder of the concrete was poured up to the bottom of the roof girders on the outside pits and to the bottom of the upper track floor in the center pits (Fig. 6). In order to provide for the horizontal sheeting in the main excavation, a groove was left in the outside piers into which the 4-in. horizontal sheeting could be framed as the excavation proceeded. After the concrete had set, grillage cap beams were placed over the columns and the radial beams were shimmed to bear on the columns. Diagonal steel bracing was bolted to the columns above the concrete piers for lateral stiffness.

General Excavation—Upon completion of the underpinning, two clamshell cranes, one on each end of the crossing, removed as much of the excavation as could be reached. Conveyors were then used to throw the material out to the cranes. As the excavation advanced the steel columns were braced across the cut until it was possible to introduce the roof girders. The 4-in. sheeting proved amply strong to span from pier to pier. When the subgrade of the lower track was reached, the center footing was poured and the structural steel erected and riveted. The center walls were concreted and then backfilled, grading at the same time taking place on the upper level track floor. The upper floor was concreted and the other concrete operations followed as in the usual type of subway construction. Since the sidewall concrete arches of standard form could not be constructed adjacent to the underpinning piers, these adjacent wall bays were reinforced to act as vertical beams with depressed panels to form safety niches.

The track cradles and radial beams were removed after the backfill cover was placed over the subway.

The Long Island Railroad completed its electrification during the life of this contract, and one of the columns supporting the catenary system was located above the subway just east of the railroad. It was necessary to support the member temporarily on timber horses until the completion of the subway, after which a new pier was formed on the roof of the subway. Just west of the railroad crossing one of the catenary piers had to be underpinned because of the adjacent subway construction. A track cradle was constructed similar to that used to carry the railroad tracks over the subway. The column and pier were carried on steel beams, resting on cribbing. The underpinning excavation then proceeded without endangering either the railroad track or the column.

The work was performed by the Corson Construction Corporation, of which the writer is engineer, under the supervision of the Board of Transportation of New York, of which Robert Ridgway is chief engineer and

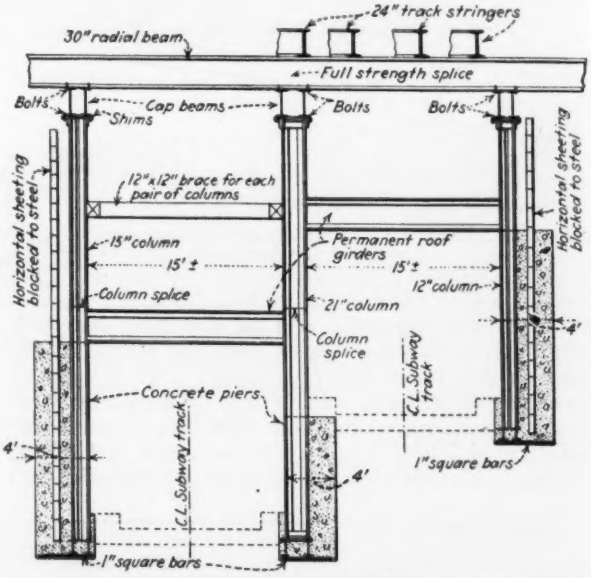


FIG. 6—CROSS-SECTION OF COMPLETED UNDERPINNING

J. R. Slattery is deputy chief engineer. J. O. Shipman is division engineer and B. Houtaling section engineer in immediate charge of this work. The contractors are greatly indebted to F. Auryansen, bridge engineer of the Long Island Railroad, for his suggestions and criticisms both in the planning and in the execution of the work.

Foreign Trade in Cement Shows Increase

The Department of Commerce has announced that imports of cement during March, 1928, totaled 235,930 bbl., valued at $330,074, a quantitative increase of 30 per cent over March, 1927.

Belgium furnished 81 per cent of the total imports, or 190,006 bbl., as compared with 73 per cent (131,498 bbl.) during the corresponding month last year. During the first three months of 1928 imports totaled 630,823 bbl., valued at $890,396, as compared with 504,741 bbl., valued at $731,860, for the first three months of 1927. Corresponding figures on exports are: March, 1928, 74,983 bbl. ($265,719); March, 1927, 67,956 bbl. ($240,-165); first three months of 1928, 194,211 bbl. ($692,-214); first three months of 1927, 214,706 bbl. ($728,222.)

Highway Bridge of Graceful Contour in North Carolina Mountains

Structure Built by State Highway Commission Achieves Both Boldness and Beauty by Using Unsymmetrical Side Arches

A HIGHWAY bridge of striking appearance has recently been completed by the North Carolina State Highway Commission, spanning a mountain gorge on the Asheville-Spartanburg highway. High Bridge, as it is called, incorporates a bold treatment of the side spans, using unsymmetrical flanking arches, one side of which rises from the level of the main arch springing line.

The design was adopted after comparative estimates had been made on several types of bridges, including steel viaduct construction. The location of the bridge between a power dam and a power house is such that under normal conditions the flow of the stream is taken through an 8-ft. penstock, and the stream bed is practically dry. Thus the contractor was able to excavate all the foundations without having any kind of pump on the job, a somewhat unusual occurrence on bridge work.

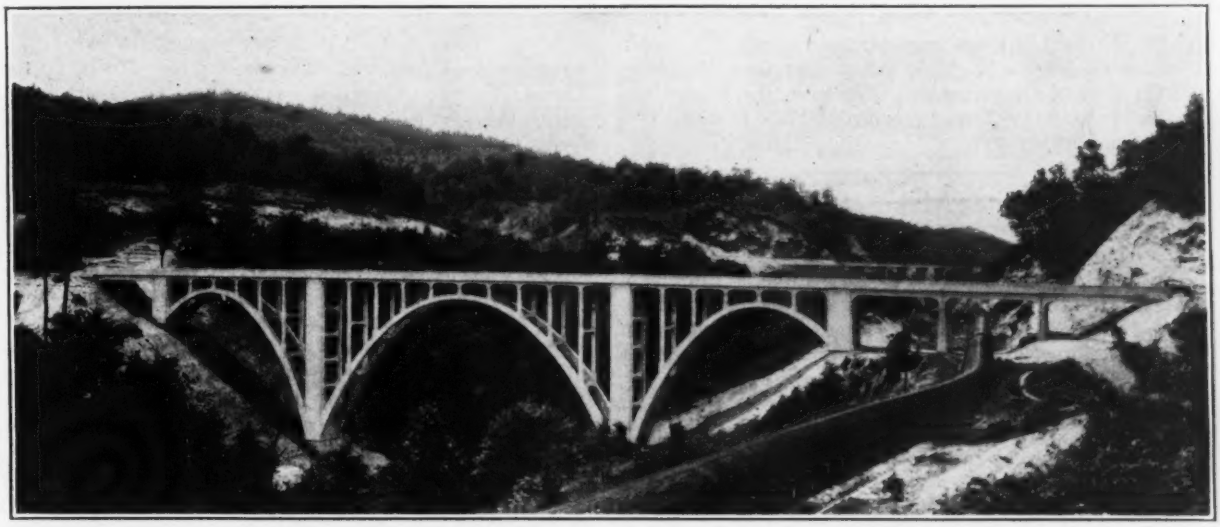


FIG. 1—A STRIKING BRIDGE ON THE NORTH CAROLINA HIGHWAY SYSTEM
Note the successful use, from an esthetic standpoint, of unsymmetrical side arches.

As shown in Fig. 2, the bridge is 580 ft. long, consisting of a 175-ft. symmetrical arch, flanked by 100-ft. unsymmetrical arches and with three 40-ft. deck girder spans on one end and one 40-ft. deck girder span on the other. The roadway is 20 ft. between curbs, and the design provides for live loading H-15, as specified in the American Association of State Highway Officials specifications. The roadway grade is 135 ft. above the bed of the stream, while the 175-ft. arch span has a clear rise of about 80 ft. and consists of two ribs 4 ft. wide and 2½ ft. deep at the crown. The arch ribs spaced 16 ft. 3 in. center to center are connected by tie beams 2 ft. wide placed at each column point. Above the ribs 2-ft. square columns support the superstructure, which is of the deck girder type, continuous over two spans. The 100-ft. unsymmetrical arch spans have a clear rise equal to that of the main span on one side, but a rise of only 17½ ft. on the other.

Two of the 40-ft. deck girder spans consist of three girders at 8-ft. centers, with the handrail and curb overhanging the outside girder. The two end spans are each made up of four girders, permitting the roadway to widen to 30 ft. at the end of the bridge.

Construction—The symmetrical arch was poured in five sections and the unsymmetrical arches in three sections, each section containing approximately 45 cu.yd. Wooden trestle falsework was used with post lengths of about 26 ft. The greatest height of wooden bents was 125 ft., with a 22½-ft. width at the top and a 42-ft. maximum width at the base. Sawed timber was used in preference to round posts as an aid in fastening cross-bracing. Little settlement of falsework was experienced, the amount being slightly less than $\frac{1}{16}$ in. per joint of wood, which was the amount allowed in setting elevations on the intrados form.

Because of the steep slopes at the bridge location, the contractor was able to build a short trestle siding from the main track of the Southern Railway from which the aggregate could be dumped directly into the storage bins. From the bins the material was carried by gravity to measuring boxes located at the mixer. Likewise, the cement was unloaded down a chute to the storage house, and coal was dumped near the boiler. Water was also obtained by gravity from a source nearby.

A cableway located along the center line of the bridge transported concrete from the mixer to the forms. The cableway span was approximately 700 ft. between towers. During the winter the concrete was protected from freezing by using heaters and tarpaulin covers. Because of the height of the structure and the almost constant wind which blew down the gorge, winter concreting was particularly difficult. Frost in the aggregate was eliminated by heating the mixing water to about 100 deg. F. before placing in the mixer. As the sand was measured in a saturated condition, the heat from the water was sufficient to raise the temperature of the batch to around 50 deg. F. as it came out of the mixer.

Plans for the bridge were prepared by the North Carolina State Highway Commission under the supervision of William L. Craven, bridge engineer. F. W. Hunter was the designer of the bridge. Construction was in charge

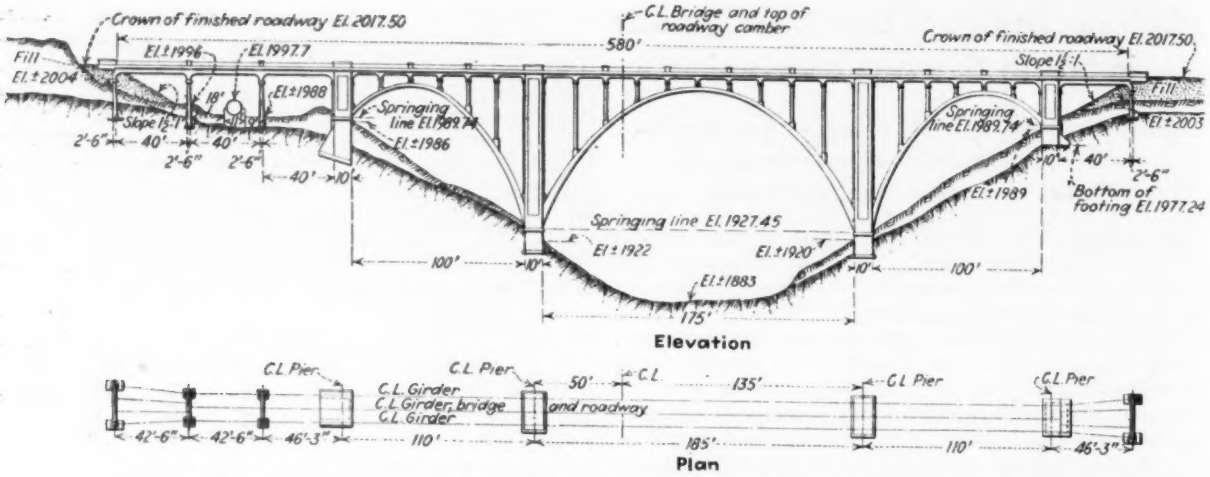


FIG. 2—PLAN AND ELEVATION OF HIGH BRIDGE, ON ASHEVILLE-SPARTANBURG HIGHWAY, N. C.

of H. E. Noell, district engineer, and Neely J. Cromer, resident engineer. E. A. Wood & Company, Andrews, N. C., were the contractors. Work on the bridge was started June 1, 1927, and completed May 1, 1928, at a total cost of $113,000.

Breaks in Water Mains at Cleveland and Cincinnati, Ohio

Three water mains in one locality broke at Cleveland, Ohio, on June 19, doing considerable damage and on June 24 a main broke at Cincinnati. Information on the breaks in each city has been supplied to *Engineering News-Record*, as noted below.

Cleveland, Howell Wright, Director of Utilities—About 1 a.m., June 19, breaks occurred in three cast-iron bell-and-spigot water mains on Superior Ave. and West 6th St., in close proximity to the excavation for the new Cleveland Union Terminals. The breaks wrecked a 12-in. gas main, tore up and twisted a number of cables, ripped a hole in the street about 50 by 80 ft., washed about 2,500 cu.yd. of material into the Union Terminal excavation, and completely tied up east bound street car and automobile traffic. The mains in which the breaks occurred were an 8-in. distribution main, a 30-in. supply main and a 16-in. high-pressure fire line. At the time the breaks occurred, each of the mains was carrying a pressure of about 60 lb. per square inch.

The oldest of the three mains, the 8-in., was laid in 1875. The 16-in. high pressure fire line was laid in 1906 and, at the point where the break occurred on the 30-in. main, part of the line had been laid in 1917 and part in 1926.

The excavation of the Union Terminals Company had been carried to a depth of approximately 30 ft. below the general street level and steel sheet piling had been driven from the easterly end of the excavation to a point about 27 ft. west of the center line of West 6th St. West of this point the original ground had been stepped back toward the excavation about 20 ft. and then allowed to take its natural slope. The line of the sheet piling ran, for a distance of about 20 ft., within 6 ft. of the center line of the 30-in. main. The break occurred near the end of the sheet piling.

When the new 30-in. main was laid in 1926, due to underground obstructions, a 90-deg. bend was placed near the center line of West 6th St. and backed with a large block of concrete. The sheet piling driven by the Union Terminals Company left practically no earth backing to this concrete. It is impossible to say which main broke first, though it is quite probable that the pressure at the bend, deprived of its earth backing, combined with vibration from work at the terminals, may have caused the bend to push out and this, having washed the foundations from under the other mains, caused them to break. On the other hand a break had occurred in a 20-in. main on the opposite side of the street a short distance away some months ago and this was undoubtedly helped by vibrations at the terminals. This might indicate that either the 8- or 16- or even the 30-in., at some point other than at the bend, may have let go first.

The water was shut off within about an hour after the breaks had occurred and work was started removing the débris. By the next afternoon the hole in the street had been filled and traffic was completely resumed. The broken mains were not immediately connected, however, as the water department was able to bypass the break without depriving anyone of water. Immediate steps, however, were taken to drive piles to support the 30-in. main across the hole in the street and preparations were made for substituting steel for the broken line.

Cincinnati, C. O. Sherrill, City Manager—On Sunday, June 24, a break occurred in the 36-in. cast-iron water main on Court St., just east of Reedy St. About 40x100 ft. of granite street paving was torn up.

This is one of the mains from Eden Park Reservoir. It was laid in 1877. The pipe thickness varied from $1\frac{3}{8}$ to $1\frac{1}{16}$ in. There was practically no corrosion, the original coating being in good condition both inside and out. This is the first break which has occurred on this line and no cause for it can be assigned.

The break occurred at 9:30 a.m. Valvemen responded immediately. All damaging flow was stopped by 11 a.m. and by 1:30 p.m. a complete shutdown was effected.

Carquinez Bridge Traffic Heavy

Announcement has been made of the amount of traffic carried during the first year of operation of the new Carquinez Strait bridge in California. The total number of automobiles crossing the bridge was 1,075,583. Persons crossing the bridge totaled 2,790,914.

Civil Engineers Discuss Problems of Niagara Frontier

Preservation of Niagara Falls by Distributing the Flow Over Crest—Past and Future Power Development Around the Falls—Difficulties Involved in Controlling Levels in the Great Lakes by Regulating or Compensating Works at the Outlet

MEETING in Buffalo, N. Y., July 18-20, for the first time in more than 40 years, the American Society of Civil Engineers devoted the major part of the time of its 58th annual convention to the consideration of questions of special interest to that region. Preservation of Niagara Falls, water supply and sewage disposal at Lake Erie and the Niagara River, Niagara power and the regulation of the flow and levels of the Great Lakes were the subjects of discussion at three technical division meetings and one general technical session.

Formal sessions began on Wednesday, but many members went to Buffalo on Tuesday for two sessions of the local section's conference. The convention was called to order by Edward P. Lupfer, president of the Buffalo Section, and after an address of welcome by Louis G. Harriman, president of the Buffalo Chamber of Commerce, Lincoln Bush, president of the society, delivered his annual address, taking as his subject the work of the construction division of the army during the war and the attempt to discredit it following the war.

Preservation of Niagara Falls

Technical sessions began with the paper by Walter McCulloh, of Niagara Falls, on the engineering pioneers of the Niagara frontier, in which he described briefly the many early works of engineering interest of that region. He was followed by Major Robert F. Thomas, the new district engineer officer of the Corps of Engineers at Buffalo, who presented the interim report of the Special International Niagara Board on the Preservation of Niagara Falls. An abstract of this report was given in *Engineering News-Record* Feb. 23, 1928, p. 332. Briefly, the report recommends the immediate undertaking of remedial work to cost about $1,750,000 to increase the flow over the American Falls and the flanks of the Canadian Falls by diverting water from the center of the Horseshoe Falls. The board proposes that the work be done by a small amount of excavation close to the Falls and by the construction of submerged weirs in the rapids above the Falls.

Discussion of these papers centered upon the preservation of the Falls. J. B. Challies (Montreal), presented a written discussion by Julian C. Smith, president of the Engineering Institute of Canada, in which he advocated cautious cut-and-try methods in changing the flow over the Falls to see what effect the proposed changes would have upon ice conditions.

Glenn C. Forrester (Niagara Falls), author of a book on the geological history of the Niagara River and Falls, indorsed the statement made by the international board in its report, to the effect that the Falls is not "committing suicide." As a result of his studies of the geology of the gorge he believes that the present deep cutting at the center of the Horseshoe Falls and the unwatering of its flanks have been repeated a number of times in the past as the river cut its way back from the escarpment.

The difficulties overcome and some of the results obtained in designing and constructing a model of Niagara Falls for the Niagara Falls Power Company were described by Douglas Ellis, professor of civil engineering, Queen's University. The model was built to a scale of 1 to 100 horizontal and 1 to 25 vertical, with velocities one-fifth those of the river and discharges about 1/12,500.

Present conditions of flow and the methods of constructing weirs to raise the level of Grass Island pool to equalize the flow over the Falls were described by Oliver D. Dales, construction engineer, Niagara Falls Power Company. Mr. Dales pointed out that only 9,000 sec.-ft. go over the American Falls, whereas 145,000 sec.-ft. go over the Horseshoe Falls. When asked how much more water could be diverted for power purposes after the remedial work had been completed, Mr. Dales said that he could make no estimate because of the divergent views as to what constituted a satisfactory amount of water over the Horseshoe Falls, many persons maintaining that the deep green color of the central portion of that Falls, where the greatest quantity of water is concentrated, is one of the chief beauties of the spectacle.

Replying to a criticism of the power companies in which one speaker stated that they hid their ultimate purpose of getting more water for power purposes behind a screen of favoring improvements in the appearance of the Falls, Morris Knowles (Pittsburgh) deprecated such reflections upon the integrity of the engineers of the power companies, and stated that if the aims of those who wished to save the Falls and of those who wish to draw more water are not incompatible, then the proposed remedial works should not be opposed by one party simply because the other might benefit thereby.

Niagara Power

The attention of the Power Division was turned to the power development side of the Niagara Falls problem during Wednesday morning, when Norman R. Gibson, vice-president and chief engineer of the Niagara Falls Power Company, presented in abstract form a paper written by him to set forth the history of power development at the Falls and the many problems connected therewith. At the present time the installed capacity of all the plants on the river is 1,587,000 hp. All of this installation is not used, because of the limits upon the diverting of water for power purposes. With the present limit of 56,000 sec.-ft., the daily average output of the plants is 1,137,000 hp., and the peak output 1,388,000. The maximum diversions officially recommended to date are 100,000 sec.-ft. around the Falls and 40,000 around the lower rapids.

With this amount of water, by scrapping the most inefficient of the present plants and building new ones to utilize the 220 ft. at the Falls, the development could be

increased to 2,500,000 and 3,000,000 hp. on peak. Mr. Gibson believes, however, that more than 40,000 sec.-ft. can be diverted below the Falls without impairment of the scenic beauty or ice-discharging capacity of the rapids. Such diversion would raise the development to 3,000,000 and 3,600,000 hp. on peak. Mr. Gibson is of the opinion that it is not *now* necessary to decide on the ultimate development. Preservation of the scenic value may be insured by a step-by-step development. An increment of 20,000 sec.-ft. is sufficient water for one step. He believes that it is beyond question that the most logical step is construction of the remedial works proposed by the international board and of a new plant on the American side to utilize initially 10,000 sec.-ft. under a full head of 312 ft.

Discussing Mr. Gibson's paper, Thomas H. Hogg, hydraulic engineer, Hydro-Electric Power Commission of Ontario, explained the greater capital costs of power in Ontario, which were given by Mr. Gibson, as being due to the commission's policy of getting wider distribution of power, also to the fact that the Queenstown-Chippawa plant was an expensive one to build.

The expected life of power plants also is an important factor in power development costs, said Mr. Hogg. Looking back over the history of power development at Niagara Falls as outlined by Mr. Gibson, he drew attention to the fact that some of the older plants had become obsolete in less than 30 years. Fifty years, he thinks, can be assumed as the life of a modern plant.

The federal government side of power development at Niagara Falls was presented by Major Glen E. Edgerton, chief engineer, Federal Power Commission. It is necessary to interpret the law to suit local conditions, rather than to apply it literally, said Major Edgerton, in referring to the Federal Power Commission's authorization of the most recent plant of the Niagara Falls Power Company and its decision in the matter of the uniformity of daily diversions authorized under the present treaty with Canada. In the latter case the commission decided that 20 per cent in excess of the 20,000 sec.-ft. available on the American side can be diverted for peak load, provided the total daily diversion does not exceed the total allowed at the uniform rate.

Among others who discussed the paper were Col. Charles Keller and Col. William Kelly, both of whom were concerned with Niagara power at different times before their retirement from army service. Colonel Keller favors an ultimate diversion from the Falls of 100,000 sec.-ft., but he believes that an increase of more than 40,000 from the gorge would be detrimental to its ice-carrying capacity. Due to the conformation of the region around the Niagara River, Colonel Keller believes that the greatest economy would result from developing the whole head in one plant on the New York side, if statesmen could be persuaded to agree to such an arrangement.

Regulation of Great Lake Levels

Control of the levels of the Great Lakes, chiefly Erie and Ontario, was the subject of a long discussion by the Waterways Division, the discussion being led by Col. George B. Pillsbury, a member of the international board which reported to the governments of the United States and Canada on that subject in connection with its report on the St. Lawrence waterways. Regulation of the flow in the outlet from the Great Lakes is so intimately connected with navigation, with the occupancy of low lands bordering on the lakes and the drainage of municipal areas along the lakes, said Colonel Pillsbury, that the interests of all must be considered in any plans for either regulating or compensating works at the lake outlets. On Lake Erie, for example, the level at Buffalo may vary from 9 ft. above the mean to 4 ft. below it during storms. Both Buffalo and Detroit are seriously affected by these changes and would not tolerate either a permanent increase in the lake levels for navigation purposes or a temporary increase for the storage of water for power. Attempt to increase the *minimum* low flow at the expense of the average low flow would be detrimental to power development. Conditions at Montreal must be considered in any proposed change in the discharge from the Great Lakes, said Colonel Pillsbury. The ordinary low levels must not be reduced, nor must there be any increase in the spring flows when the ice is going out.

Conflicting Interests in Lake Levels

Present seasonal fluctuations in the level of Lake Erie smooth out the rate of outflow by about 50,000 sec.-ft., said Colonel Pillsbury. To attempt to stabilize the lake level would reduce this effect and would be detrimental to power development. On the other hand, regulation for the benefit of the power companies must not be carried to the point of holding back water for storage purposes in the spring to the detriment of the river's ice-carrying capacity.

Colonel Pillsbury believes that the odds are against any attempt to regulate the levels or flow of the Great Lakes. However, he believes that the study should be continued until all the facts are definitely established.

O. O. Lefebvre, chief engineer, Quebec Streams Commission, indorsed this view in a telegram to Colonel Pillsbury, stating that he would not be able to attend the meeting to take part in the discussion. Colonel Kelly expressed similar views at the meeting of the Power Division early in the day. He stated that few realized what a slight field there is for regulating the lakes, due to the fact that the lake surfaces constitute one-third of the drainage area.

Robert H. Horton (Albany) said that the mass diagrams and duration curves used in most studies for the regulation of the Great Lakes do not give a true picture of what may be accomplished. He proposed the use of operating schedules based upon past records and present conditions, similar to those used by power companies in operating their own storage reservoirs, for regulating the Great Lakes. The regimen of the lakes, as regards rainfall, has not changed much in the past hundred years, Mr. Horton said, so that we may confidently expect an upward turn in lake levels. This, he said, will severely affect those who have built on low-lying shore land along the lakes, whether regulation is attempted or not. He also believes that the study should be continued, particularly the hydrologic aspects.

Commercial aspects of the effect of regulation were presented by L. L. Davis (U. S. Engineer Office, Buffalo). Mr. Davis believes that the navigation interests are of primary importance in any plan to regulate lake levels.

Water Supply From the Great Lakes

The Sanitary Division also turned its attention to problems of the Niagara region, taking up the subject of water supply from the Great Lakes and sewage and refuse disposal. Discussion of water-supply matters centered around papers of Earl Devendorf, associate director, division of sanitation, New York State Health Department, and George H. Norton, formerly city engi-

neer, Buffalo. Mr. Devendorf believes that there is little possibility of Cleveland or Erie polluting the supply which Buffalo draws from Lake Erie. The chief sources of such pollution are small towns between Dunkirk and Buffalo and the city of Dunkirk, the latter having no sewage-treatment plant at present, although one is in prospect. Large manufacturing plants on the outskirts of the city also contribute to the pollution. Lake water movements, said Mr. Devendorf, normally cause the polluted water to hug the American shore, but storms on the lake may stir up the water and cause pollution to reach the Buffalo intake. One of the industrial plants is disposing of its phenol wastes by pumping them through drilled wells 300 ft. deep to a brackish water stratum found at that depth. Another plant is treating its wastes with potassium permanganate to eliminate objectionable taste. Studies are now under way, said Mr. Devendorf, to determine the effect of pollution of Lake Erie and the Niagara River upon fish life. These studies, he believes, will be useful in connection with the water-supply study.

George H. Norton stated that the International Joint Commission, formed in 1909, was instructed to study the pollution of Lake Erie and suggest remedies therefor. Sanitary surveys were made at Detroit and in the Niagara region, and in a report published in 1916 the commission recommended sewage treatment at Buffalo. Subsequently negotiations were started for the formation of a joint board of control with power to formulate regulations over sanitary conditions not vested in the International Joint Commission, but the war put an end to the work and nothing has been done since. In the discussion which followed, George W. Fuller (New York) amplified the statements made by Major Norton, and pointed out the need for arousing public opinion to the necessity for sewage treatment in the Niagara region. Discussion of the paper by Harrison P. Eddy (Boston) was concerned chiefly with the effect of contamination in producing epidemics of water-borne diseases in the cities of the Niagara district.

A notable feature of the sanitary work on the Niagara frontier, said Frank C. Tolles (Cleveland), is the attempt to establish a standard of permissible pollution. Referring back to the subject of the disposal of phenol wastes by pumping them into drilled wells, James M. Caird (Troy) stated that such methods of disposal may lead to serious trouble and that phenol disposal must be the subject of further study. He gave some experience in the use of potassium permanganate at the filter plant of the Western New York Water Company at Niagara Falls in combating phenol tastes.

Waste Disposal—Refuse and garbage disposal in European and American cities was the subject of a paper by Francis L. Pruyn, vice-president, American Beccari Corporation, New York. He described a number of European and American incineration plants and stated that European plants are more expensive than most American plants, because the utilization of byproducts involves expensive machinery. Of the American plants, he described the Heenan-Froude plant at Buffalo and the Decarie plants at Philadelphia and Providence. In conclusion, he stated that American plants might well copy the European practice of using waste heat. In the discussion of Mr. Pruyn's paper, John P. Lewis (Rochester) stated that he doubts the economy of recovering salable products but that there are many possibilities for other proved economies in most American plants.

Further details of the new Buffalo incinerator were given by John H. Feigel (Buffalo). He stated that the new plant in May, 1927, took over the whole load of city garbage and refuse and had been doing a satisfactory job. Mr. Feigel was sharply critical of the present American practice of not utilizing all known methods of making the operation of waste-disposal plants economical.

Technical Activities Reorganized

Reorganization of the society's technical activities was approved by the board of direction, following the recommendation of its committee on technical expansion. The committee proposes giving wider scope to the work of the technical divisions by the organization within them of committees to which will be assigned definite subjects for consideration and report. In order to make a permanent record of this work, the reports of division committees are to be printed independently of the *Transactions* or *Proceedings* of the society as *"Separates,"* publications which will crystallize the work of the technical committees.

Under this reorganization plan the general direction of the work of each technical division will be vested in an executive committee of five, only one member of which is to be elected each year, in order to keep the committee as permanent as possible. Subjects of interest are to be assigned to committees appointed for the purpose, and the committees are to have their reports prepared, printed in the *Proceedings* and distributed to members before each meeting so that they may come prepared to take part in the discussion. After discussion, a vote will be taken as to whether the report is to be returned to the committee for modification or forwarded to the board of direction for adoption. If forwarded and adopted, it shall then be printed and published as a *Separate*.

Publications—Ultimately, the publications of the society under this new system will be of three types: *Transactions, Proceedings* and a series of *Separates*. The *Transactions*, "the archives for the technical activities of the society, shall contain only the essential facts concerning the development of the art and science of engineering of admittedly prominent value." Statements and illustrations contained therein are to be confined to the smallest compass possible. Material readily accessible elsewhere is not to be printed in the *Transactions*. The *Proceedings* are to continue to be the forum of the society and are to contain much the same material as now, with the addition of technical committee reports and a section for communications from juniors on engineering subjects not of sufficient importance to justify treatment as papers of the society. Memoirs are to be published in *Proceedings*. The *Separates* are to form the third part of the society's publications. As stated previously, each one will be concerned with a special subject, and so is to be bound separately.

The committee on technical expansion has been continued to assist the secretary of the society in putting its recommendations into effect.

Power Plants Visited

Power plants at Niagara Falls were visited on Friday by a number of those attending the convention. The parties traveled by bus from Buffalo to Niagara Falls, Ont., crossing the river by the new Peace Bridge. From there the parties proceeded to the Queenston-Chippawa plant and returned on the American side to Niagara Falls, N. Y., where they were shown a model of the Falls and were taken through the larger of the Niagara Falls Power Company's plants.

From Job and Office

Hints That Cut Cost and Time for the Contractor and Engineer

A New Mold and Concrete Test Methods on Port of N. Y. Authority Bridges

By A. W. Munsell
Engineer of Masonry Construction, Port of New York Authority

THE type of mold used by the bridge department of the Port of New York Authority for making test cylinders in the field, and the form used for recording the necessary data, are shown in the accompanying illustrations. The mold consists of three pieces, an 8x16-in. cylinder, a bottom plate with band attached,

FIG. 1—TYPE OF 8x16-IN. MOLD USED, AND SAMPLE TEST CYLINDER

and a top plate. The cylindrical rolled-steel form, of $\frac{1}{8}$-in. stock, has two $\frac{3}{8}$-in. round handles fastened with four countersunk rivets. The band is $\frac{1}{8}$-in. stock 1 in. wide, fastened to the cylinder with one countersunk rivet opposite the slot. On the band is welded a brass shackle with wing nut and a lug. The top and bottom of the cylinder are machined to give parallel planes. The bottom plate, 9x9x$\frac{1}{2}$ in. of cast iron, is machined on one side to 0.001 in. The band is fastened to the plate with two legs held in place with two countersunk rivets. One of the legs is slotted to permit movement of the band when the mold is drawn to a circular section. The top plate, 10x10x$\frac{1}{2}$ in., is machined on one side to 0.001 in. for capping the specimens.

In the making of the specimen, the inside of the cylinder is swabbed with oil. A sheet of onion-skin paper is placed on the bottom plate, the top band is drawn up and the cylinder form placed on the bottom plate. The lower band is then drawn up and the mold is ready for filling. The concrete is placed in four layers of approximately 4 in., each layer being rodded 25 times. The concrete is struck off and allowed to stand for several hours for shrinkage to take place, after which a neat cement paste, prepared at least two hours before use, is filled in on the top slightly in excess of the amount required. A sheet of onion-skin paper is then laid on the cement paste, and the top plate is pressed on and worked until it has a firm bearing all around the edge of the mold. The onion-skin paper at the top and bottom of the specimen prevents sticking of the concrete to the plates, and has proven very satisfactory in service. Very few repairs to the tops and bottoms have to be made when using this method. The bottom, being fastened to the cylinder, permits transportation of the specimen while the concrete is green. The cylinder, fitting snugly to the bottom plate, allows a minimum leakage of water and mortar.

It is the practice to make one specimen for each 100 cu.yd. of concrete deposited, or at least one specimen each day concrete is made. When only one specimen is made, it is broken at the 28-day period. When more than one specimen is made, one is broken at 28 days and the others are extended to three months, six months or one year. For identification, each contract is given a symbol letter and the specimens are numbered consecutively. Each specimen is stenciled with its number on the top and side so it can be found quickly in the sand storage bed.

All of the concrete mixes are designed for a certain strength with a fixed water ratio, after a complete examination of the aggregates and cement to be used on a contract are known. Inspections of all aggregates are made at the point of manufacture while being loaded on barges for shipment to the site of the work. Each

Form 47-2M-4-28

THE PORT OF NEW YORK AUTHORITY
BRIDGE DEPARTMENT
INSPECTION DIVISION
INFORMATION FOR TEST SPECIMENS

No. of Specimen _____ Date _____
Time { _____ A. M. / _____ P. M. Temp. { _____ Air / _____ Concrete
Weather Conditions _____
Contract No. _____
Specified Min. Strength _____
Exact Location _____
Gal. of Water per Sack _____
Slump _____ Brand of Cement _____

	Fine Agg.	Coarse Agg.
Lot No.		
F. M.		
% of Moisture		
Wt. in Batch		
Wt. per cu. ft.		

No. of Sacks of Cement per Batch _____
Mixer _____ Time of Mix _____
Lbs./sq. in. _____ Wt. per cu. ft. _____
Made by _____
Remarks _____

FIG. 2—FORM USED TO RECORD CONCRETE DATA

barge captain is given a ticket on which the fineness modulus, the grading, and the quantity is shown for each kind of aggregate. The ticket is given to the inspector at the place of unloading. Moisture determinations are made for fine aggregates and coarse aggre-

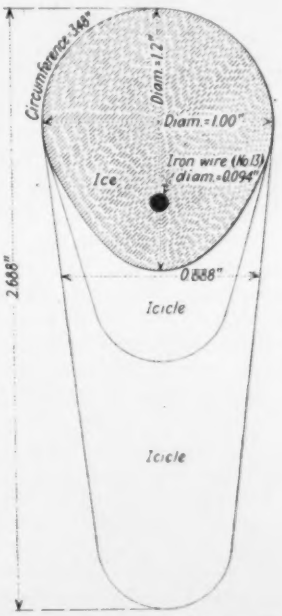
gates at the work. With this information the inspector designs the mix to be used to secure the strengths required. The weight system for proportioning mixes is used on all of the contracts now in force because of its greater accuracy and uniformity. Slump tests are made with each test piece and whenever the consistency appears to have changed from that required. When a change of consistency is indicated the correction is made by a change in the proportion of the aggregates, and not by a reduction or increase in the water.

With each test piece, the form, Fig. 2, is made out in duplicate, one copy of which is mailed to the laboratory the day the specimen is made to be recorded in a diary for its proper breaking time. From the information given on this form, tabulations are made of the strengths obtained for the various mixes and a check is made on the amount of water that is used in each batch of concrete.

Measurement of Ice Load on Michigan Telephone Wires

By R. R. Ryan, C.E.
Newberry, Mich.

ALLOWANCES for ice loads must be considered in the design of transmission lines, due to the heavy coating accumulated by the wires during sleet storms. Engineers concerned with this type of design will be interested in the actual measurements made on a telephone wire in Michigan after a heavy storm early in April. Rain from the northeast froze as it fell, covering all exposed wires with an unusually heavy coating of ice. The iron telephone wire shown in the sketch did not break, although the breaking of a pole by a falling tree-branch caused it to sag very low.



CROSS-SECTION OF SLEET LOAD ON TELEPHONE WIRE

The shaded section in the drawing was continuous. The icicles, shown in outline, varied greatly in frequency and length, there being, apparently, more icicles on taut wires than on slack ones. The spacing of the longer icicles ranged from one to four inches apart; the shorter ones were practically continuous.

In order to determine the effect of initial size of the wire on the ice coating, measurements were made on a duplex insulated telephone cable about equal in area to two of the wires shown in the sketch, and distant about ½ mile. This had approximately the same outside dimensions, indicating that the size of wires had little effect on the amount of ice deposited. A rough calculation of the ice load on the wire sketched indicated a weight of from 45 to 70 lb. per 100 ft., varying with the spacing and size of the icicles.

Truck Crane Performs Unique Building Wrecking Job

THE reinforced-concrete construction of the Armour Warehouse Building in Cleveland, which it was necessary to wreck as a part of the new Union Terminal development, made hand demolition methods of little

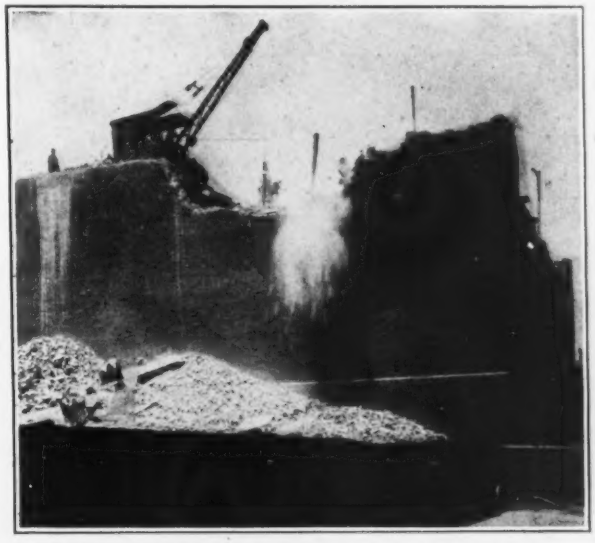


FIG. 1—TRUCK CRANE WRECKING REINFORCED-CONCRETE BUILDING

avail. The wrecking contractors, C. Lurie & Company, finally engaged a truck-crane contractor, the Painton & Martin Company, to adapt one of its trucks to the work. The use made of the truck crane is shown in the accompanying illustrations. Mr. Lurie estimates the truck crane is doing the work of 90 men with hand tools and pneumatic drills at a saving of about half the time originally scheduled for the job.

According to the Universal Crane Company, a truck-crane with a 20-ft. boom was raised to the fourth story of the building by running it up a ramp of two 20x20-in.

FIG. 2—TRUCKS EQUIPPED WITH WINCHES HAULING TRUCK CRANE TO FOURTH STORY OF BUILDING TO BE WRECKED

FIG. 3—TRUCK CRANE WAS LOWERED FLOOR BY FLOOR AS WRECKING CONTINUED

timbers 62 ft. long which rested against the buildings at about a 40 deg. angle. The crane was raised by fastening lines to the back of it, running them over snatch blocks at the top of the building, and then returning them to two winch trucks as shown in Fig. 2. The rigger, the Wahl Company, used unusual care in raising the truck crane; it required about seven hours to get the crane in position on the fourth floor.

By lifting and dropping a 3,000-lb. skull cracker, the crane was able to smash the floor panels and knock over the walls. Then by means of its clamshell bucket, the débris was picked up and dumped clear of the building, as shown in Fig. 1. The fourth and third floors were each demolished in ten days.

The plan being followed is to break down each floor until the crane is finally backed into one corner and then to run it down a short ramp of 12x12's to the next story (Fig. 3), where the operation is repeated. The lowering is accomplished by lines running over snatch blocks at the top of the building wall to the winch trucks on the ground. It requires about four hours' time and five men to lower the truck from floor to floor. The contractor estimates that it will take from six to eight weeks to complete the demolition of the building.

Building a Long Highway Embankment With Drag Scrapers

AN EARTH FILL 8,500 ft. long, connecting the levee at Memphis, Tenn., with the Harahan bridge across the Mississippi River, is being made by T. J. Galley & Company, Knoxville, Tenn. The embankment will carry a highway replacing the old timber trestle connection

From Job and Office

Hints That Cut Cost and Time

which has been damaged by both flood and fire. The specifications provide that the bank must be built up in horizontal layers with slopes of 2½ to 1. The material must be borrowed from both sides of the viaduct, and a wide berm must be left to protect the embankment.

The plant used by the contractor is of a type developed in levee construction, consisting of a crescent-shaped scraper controlled from two towers 550 ft. apart. The scraper is connected to the pull-back cable by a carrier attached to the back-plate, so that it can be raised when

FIG. 2—SCRAPER LEAVES A LEVEL BORROWPIT

necessary. For ordinary digging a 4-yd. scraper is used, but it has been found more efficient to substitute a 3-yd. scraper when attacking the tough clay which underlies the top soil. Both the 50-ft. steel head tower and the timber tail tower are self-propelling, the former by means of a reversible friction from the digging drums, the latter by a gasoline engine. Electric power is used for all operations except moving the tail tower.

During the first four months of operation this outfit averaged 47,875 cu.yd. per month at a cost of approximately 5c. per cu.yd. for labor, 3c. for maintenance and 2c. for power. The borrowpits are left in an unusually neat manner, with even banks and a level bottom. The

FIG. 1—CABLE-SCRAPER SYSTEM MAKING APPROACH EMBANKMENT FOR HARAHAN VIADUCT, MEMPHIS, TENN.

From Job and Office

For Contractor and Engineer

embankment is built very close to specified dimensions, reducing to a minimum the work of trimming.

The work is being done for the Arkansas Highway Commission, the U. S. Bureau of Roads and the Harahan Viaduct Commission, representing the city of Memphis. A Sauerman slackline cableway was used.

Water Jets Help Pull Concrete Piles

USING water jets to assist in pulling old concrete foundation piles was tried with success in preparing for the erection of a 25-story apartment building on the Lake Shore Drive, Chicago. The old building was a large private residence and garage, erected some 20 years ago and founded on Raymond concrete piles 15 to 20 ft. long, which were cast in place in steel shells. Of 575 piles, 425 had to be removed to make way for the new foundations, the others being outside the building lines.

After excavation had exposed the upper part of the piles, with a length of 8 to 10 ft. still buried in the tight sandy soil, attempts were made to pull them by means of chains attached to the bucket of a power shovel. But as the piles had no vertical reinforcement and the soil had a strong grip upon them, the concrete would break under the strain and leave the stumps in the ground. The concrete and shells were in excellent condition.

Ordinary water jets were then tried with success, loosening the sand so that the power shovel could easily pull the piles. It was necessary to use the jet at each pile while the shovel exerted a pull on the chain, as the sand would very quickly pack tight again. As this work was done during cold weather in January and February there were troubles with the freezing of pipe lines and of the water in pools around the piles. This jetting method was suggested and carried out by the Turner Construction Company, the general contractor for the new building.

PULLING CONCRETE PILE
Jet pipe shown at left. Pull applied by chain wrapped around dipper handle of power shovel

Power Pipe-Tapping Machine

TO REDUCE the amount of time consumed in making 12- and 16-in. sleeve and valve cuts by hand in large water mains, a better means was sought by the Department of Water Supply, Detroit, Mich. A 28:1 gear reduction was designed to operate in conjunction with a 2½-hp. close-quarter air drill. This machine can be operated in a ditch 25-in. wide. After the tapping machine has been set up, the gear reduction is connected directly, and with an air-compressor at hand it is ready to operate. The reduction drives the cutting shaft at 5 r.p.m. With this machine, developed in 1926, a great time saving has been effected. Formerly, hand operation required from 3 to 12 hours and a labor force of 6 to 10 men. But with the machine one man in the trench can make cuts on 12-in. and larger mains in 20 minutes to one hour. The department has one such machine in service, besides three power pipe-cutting machines for making cuts from 24 in. to 48 in. in size. These machines were described in *Engineering News-Record*, May 26, 1927. These machines were developed under the direction of C. P. McGrath, superintendent of yards, department of water supply, Detroit, Mich.

POWER-DRIVEN PIPE-TAPPING MACHINE

Letters to the Editor

A Forum for Discussion of Views of Engineers and Contractors

The Grunsky Report on the Failure of the St. Francis Dam

Sir—In the June 7 issue of *Engineering News-Record* is an editorial on our report on the failure of the St. Francis dam. Several statements, conclusions and deductions are attributed to us therein which are at variance with what is set forth in the report. We cannot understand why our contention that the dam was lifted from its base was referred to in the editorial as "sliding and overturning." What we called particular attention to was the fact, made evident by old cracks, that an unstable hillside at the east, pushing a sliding mass under the one end of the dam, and a swelling foundation lifting the other end assisted the hydrostatic uplift in tearing the dam loose from its foundation, whereupon it went to pieces. The ladder sucked into and pinched in a crack of the upstream face was merely cited as supporting evidence of the fact that the entire dam, including the block which still stands, had been lifted from its foundation.

The contact plane between mica schist and the red sandstone or conglomerate foundation which is frequently referred to as a "fault" was called a contact plane in our report and was not declared by us, as the editorial would have it, inherently to condemn the damsite. This contact plane may be a fault; but if it is, it has long been dead and does not inherently condemn the dam site.

We trust you may find it convenient to publish this letter, as it appears to us that the editorial comments must have been based on misapprehension of the substance of our report.

San Francisco, Calif., July 16, 1928. C. E. GRUNSKY. E. L. GRUNSKY.

[The report in question contained a section by Dr. Bailey Willis, and both our abstract and our editorial were based on the entire report. The abstract was necessarily brief, with a view to placing the essentials before the reader in compact form, but was intended to be exact and comprehensive. The editorial did not attempt to separate the two sections of the report, but treated them as a single document, especially in so far as the nature of the contact between schist and conglomerate was discussed.

As stated in the preceding letter, the authors hold that "the dam was lifted from its base . . . whereupon it went to pieces." This explanation of the failure differs from that deduced by other investigators, and, as it does not involve a primary foundation washout, we spoke of it as being based on the conception of sliding and overturning—that is, structural failure of the main mass of the dam. In our reading of the report, the position of the ladder formed a primary if not the main item of evidence from the actual condition of the wreckage, as to lifting of the dam from its base.—EDITOR.]

Pin-Bearing Area in Riveted Trusses

Sir—In the design of riveted trusses with pin bearing at the shoe, the pin is often located so as to pass through the webs of the end post channels, and these webs as well as the gusset plates are assumed to provide bearing area on the pin. In some cases pin plates are also added inside the webs of the end posts to increase the bearing area on the pin.

The above-described methods of obtaining pin bearing in addition to that provided by the gusset plates are incorrect. If the channel webs and pin plates are assumed to take bearing, the rivet group connecting the end post webs to the gusset plates, in addition to transmitting the end post stress to the gusset plates, will be subject to the eccentric stress produced by that part of the end reaction assumed to be carried in pin bearing by the end post webs and pin plates. This eccentric stress has a lever arm whose length is the distance from the center of the rivet group to a vertical plane through the pin. In Ketchum's "Design of Highway Bridges," second edition, p. 225, the webs of the end post channels have been incorrectly used to provide pin bearing.

When bearing is required in addition to that provided by the gusset plates, it should be obtained by pin plates located symmetrically about a vertical plane through the pin.

It would seem that this error in designing is caused by confusing riveted truss details with those of the pin-connected truss in which the end post and bottom chord act directly on the pin and independently of each other.

Lebanon, Ohio, July 17, 1928. C. H. HITTLE, Chief Engineer, Oregonia Bridge Company.

Stonefly Larvæ and the Corrosion of Steel in Running Water

Sir—In response to J. B. Naeumann's inquiry contained in his letter in *Engineering News-Record* of June 14, 1928, on stonefly larvæ and the corrosion of steel in running water, the writer wishes to advise that the stonefly does occur in the United States and that the larvæ of at least one species are found on rusting steel.

Some years ago, while directing repairs to the sluice gates at the intake works and also at the head of the penstocks of the hydro-electric plant of the Colorado Power Company near Glenwood Springs, Colo., the writer found stonefly larvæ in large numbers clinging to rusty steel bars. In all instances the larvæ were surrounded by rust scales. He took note of the fact that the larvæ were especially abundant wherever the water normally was swift, and then only on unpainted steel that had been submerged for a long time. Steel parts subject to occasional submersion or to exposure to the sun for even short periods were free from larvæ. Undamaged coats of paint afforded no lodgment for larvæ.

To what extent these insects are responsible for promoting the formation of rust, as suggested by N. Kolbenstvedt, whom Mr. Naeumann quotes, is not at all clear. While some insects secrete acids for defensive purposes (the grasshopper, the ant and the bee, for instance), the digestion of insects, generally, is known to be decidedly alkaline. Their breathing processes consume rather than liberate oxygen. Viewed from these angles, it is not apparent why steel should be affected by the presence of stonefly larvæ. It is possible, however, that rusting may be promoted indirectly through the accumulations of organic matter that find lodgment in the tangles of rust scales built up by the larvæ through continual addition. The writer inclines to the belief that the large rust protuberances described by Mr. Kolbenstvedt were the result of the work of many generations of larvæ.

Normally, the species of stonefly observed by the writer lives in swiftly flowing Rocky Mountain streams on the submerged faces of stones. It surrounds itself with tiny bits of rock as a protection against its natural enemies. Sharp-edged particles seem to be preferred, presumably because they fit together better than rounded particles. The fastening of the individual particles to each other and to the foundation stone is effected by means of silk threads as described in Mr. Naeumann's letter. In this housing it spends months under water attaining its growth, including the winter months, emerging as a winged insect during the early summer. Anyone who has tried wading barefoot across a mountain stream whose stony bottom harbored stonefly larvæ will recall the unpleasant contact with the larval abodes.

The presence of stoneflies and their larvæ is usually revealed by the water ouzel, or American dipper, a small dark-feathered bird whose principal diet consists of these larvæ, which it extracts from their housings under water. It is a common sight along Rocky Mountain streams, perched at the water's edge, whence it dives assiduously for a living. Even when the streams are largely frozen over, the ouzel may be seen at its favorite water holes diving from sunup till sundown. The writer never has seen water ouzels feeding on larvæ lodged on steel racks or other submerged steel parts. Possibly the steel work was not convenient of access or else the rust scales were distasteful to the birds.

New York, N. Y., June 28, 1928. GERARD H. MATTHES.

News of the Week

Three Men Drowned in Chicago Sewer Accident

A party of workmen cleaning and repairing the bore of a sewer connecting the Calumet pumping station and the Calumet sewage-treatment works of the Sanitary District of Chicago were recently caught in the bore by rising waters, with the result that three men lost their lives. A letter to *Engineering News-Record* from John T. Miller, manager of the department of plant and structures, states that the accident was due to a misunderstanding between the city forces and the contractor, who had requested the city to flush out the sewer. The order to open the valves was issued before the men had a chance to get clear.

Another Moffat Tunnel Suit Is Filed in Denver

The Moffat Tunnel Commission has filed suit in the Denver, Colo., District Court for the collection of $131,137 rental from the Denver & Salt Lake Railroad for the use of the tunnel. The railroad signed a contract agreeing to pay an annual rental of $345,000, but claims that it is entitled to remuneration for work done in completing the tunnel. The commissioners claim that the tunnel was complete when turned over to the railroad. Another suit, now pending, requests nullification of a portion of the bonds issued by the Moffat Tunnel Commission which were, it is claimed, issued without authority. Full details were given in *Engineering News-Record*, July 5, 1928, p. 31.

Lamme Medal Awarded by S.P.E.E.

The first award of the Benjamin G. Lamme gold medal "for accomplishment in technical teaching or actual advancement of the art of technical training" has been made to Prof. George Fillmore Swain, of Harvard University, by the Society for the Promotion of Engineering Education. Professor Swain is well known as a practical engineer, writer and teacher. He started teaching at the Massachusetts Institute of Technology in 1887, but has been a faculty member of the Harvard Engineering School since 1909. He has also served as consulting engineer for the Massachusetts Railroad Commission and for a number of other engineering enterprises in the transportation and other fields. Professor Swain is a graduate of the Massachusetts Institute of Technology and of the Royal Polytechnic School of Berlin, and holds honorary degrees granted by New York University and the University of California.

Dam at Hollywood Found Safe by Two Independent Studies

Boards of Engineers and Geologists Pass Upon Safety of the Mulholland Dam

Two independent reports have been filed in Los Angeles this week vouching for the safety of the Mulholland dam above Hollywood and referring to sixteen shot drill borings recently put down through the concrete and into the foundation along the downstream face. The cores are 5 in. in diameter and give accurate indications of condition.

The committee, consisting of L. C. Hill, chairman, R. E. McDonnell and R. T. Hill, appointed May 11 by the Los Angeles Board of Water and Power Commissioners, submitted a special progress report on the Mulholland dam on July 24. Their investigation showed the foundation to be secure and the dam itself structurally adequate and safe with reservoir full. A perfect bond was found between the concrete and the foundation rock. "Foundation pressures and stresses in the concrete are low and the resistance to sliding on the base, even considering full uplift, is 0.67." Needed fire protection and water service generally in Hollywood make it imperative that at least 4,500 acre-ft. must continue to be stored in Mulholland reservoir even after the lost St. Francis storage is replaced.

On July 23 a report filed with the city council by the committee consisting of A. J. Wiley, Boise, Idaho, Charles H. Paul, Dayton, Ohio, and F. C. Herrmann, San Francisco, states that the 29 dams of the municipal water department are safe. This committee after particular attention to the Mulholland dam finds "that the Mulholland dam is a solid concrete structure of proved and conservative type; it is built upon a sound and durable sandstone rock of ideal position and structure with respect to the dam to give unquestioned security as a foundation. The dam is well designed, it is well built and the concrete is of ample strength to resist all the stresses to which it is exposed."

The report continues: "It is our judgment, therefore, that this dam is a safe and permanent structure." As to earthquakes, the committee quotes F. L. Ransome and Robert T. Hill, geologists, who aided in the investigation and who find that the dam "would probably survive even in the unexpected event that movements along any of the active or supposedly inactive faults of the region should be so violent as to lay in ruins the cities of Los Angeles and Pasadena."

Approves Washington Bridge Award

The Finance Commissioner of Rhode Island has given his approval to the recent award of the contract for construction of the Washington St. bridge over the Seekonk River at Providence, R. I., for $2,984,000. The structure, which is to replace a steel bridge, will consist of twelve concrete arches and a 150-ft. steel bascule lift over the channel of the river. The total length, including approaches, will be 2,408 ft., and the width 80 ft. The contract, which calls for completion of the structure in 27 months, was awarded to the Merritt-Chapman & Scott Corporation, New York, which will start work at once. A bid of $2,836,296 was submitted by the H. P. Converse Company, of Boston. No explanation of the reasons of the Bridge Commission for not awarding the contract to the lowest bidder was made public.

Vienna Scene of Structural Engineers' Congress

The Second International Congress on Bridge and Structural Engineering will be held in Vienna, Austria, beginning September 24 of this year. The committee has arranged for a series of lectures by structural experts from many nations on the fundamental problems of steel and reinforced-concrete construction. Beside the general conferences, sectional meetings are being planned, although the programs for these are still in the provisional stage.

Lincoln Bush, president, Am.Soc.C.E., is the American member of the committee on arrangements.

American Engineer Honored by Belgium

Edward Dean Adams, chairman of the committee on war memorial to American engineers and representative of the Engineering Foundation at the Louvain dedication, has received an honorary doctorate from the University of Louvain, and has also been made a commander of the Order of the Crown by the Belgian government.

Alcove Dam Contract Awarded

The contract for the construction of the Alcove dam of the Albany (N. Y.) water supply has been awarded to Winston & Company, Inc., of Kingston, N. Y., for $747,449.25. This is the second project in Albany's new $12,000,000 water system. The dam will be a compacted embankment 2,100 ft. long and 85 ft. high, and will contain about 320,000 cu.yd. The contract was awarded to the low bidder.

V. T. Boughton Becomes Managing Editor

V. T. Boughton, for the past five years assistant editor, has been appointed managing editor of *Engineering News-Record*. Mr. Boughton was born in Troy, N. Y., in 1888 and was graduated in civil engineering from Lafayette College in 1911. Upon graduation he went immediately to Canada as an instrumentman in the maintenance-of-way department of the Canadian Pacific Railway at Sudbury, Ont. The following year he was appointed division engineer at Chapleau, Ont., and four years later returned to Sudbury as division engineer.

At the entry of the United States into the World War, Mr. Boughton came to New York and enlisted in the Eleventh Engineers (Railway), U. S. Army, going to France with that unit in July, 1917, as a master engineer. He was commissioned the following year and subsequently was promoted to the rank of captain.

After the war Mr. Boughton returned to Canada to become assistant superintendent on the Chapleau division of the Canadian Pacific Railway, a position which he held until January, 1921, when he resigned and returned to the United States, becoming an assistant engineer in the New York Water Power Investigation. He continued in this work until August, 1922, when he went to Glens Falls, N. Y., as an inspector on the canal work of the hydro-electric development at Sherman Island.

In April, 1923, Mr. Boughton joined the editorial staff of *Engineering News-Record*. During the time that he has been on the staff he has specialized in railway and hydro-electric work, has served as news editor and in recent months has been acting as assistant to the managing editor.

Mr. Boughton is a member of the American Railway Engineering Association and an associate member of the American Society of Civil Engineers. He is secretary of the New York section of the latter society.

Electric Traction Expert Dies

Edwin Britton Katté, chief engineer of electric motive power for the New York Central Railroad and well-known consulting engineer on electric traction and terminals, died July 19 at his home in Irvington, N. Y., aged 58. Mr. Katté had charge of the design, construction and maintenance of the electrical system of the New York Central Railroad for nearly 22 years, and has been prominently identified with railway electrification development in many parts of the United States. He was consulting expert on the electrification of the Detroit Tunnels, and on terminals for Cleveland and Chicago. He was a former president of the New York Electrical Society, a former vice-president of the American Society of Mechanical Engineers, a fellow of the American Institute of Electrical Engineers, and a member of the American Railway Engineering Association, for whom he had served on committees on standards, heavy traction, and electrolysis. He always took great interest in technical society activities.

Mr. Katté, son of the late Col. Walter Katté, himself a civil engineer, was born in St. Louis, Mo., Oct. 16, 1871. He graduated from Cornell University as a mechanical engineer in 1893, and one year later received the advanced degree of M.M.E. After a short time of service with H. R. Worthington, Mr. Katté became assistant engineer for the New York Central, with which he stayed for the rest of his life. During the war he was chief engineer of electric traction for the U. S. Railroad Administration, and from 1917 to 1919 was a major in the Engineer Officers Reserve Corps of the U. S. Army.

St. Lawrence Power Project Not Yet Approved

The report that the Canadian government has approved the application of the Beauharnois Light, Heat & Power Company for the development of hydro-electric power on the St. Lawrence River near Montreal is denied by the Ottawa authorities, as no such approval has been given. While the Quebec legislature approved the application of the company, the federal authorities are waiting until the Supreme Court of Canada has given its findings concerning the ownership of the water-powers on the St. Lawrence and other navigable waters before deciding on the application of the Beauharnois company. The news item in *Engineering News-Record*, July 19, 1928, p. 110, is therefore in error.

Montreal Gets Works of Water and Power Company

A seventeen months' controversy over the purchase by the city of Montreal of the water-works of the Montreal Water & Power Company, which supplies a part of the city and some outlying territory, was ended on July 13 by payment to the company of the cash required to effect the change in ownership. The purchase price, as of Feb. 29, 1927, fixed by condemnation proceedings, was slightly under $15,000,000.

On Feb. 12, 1927, the company offered to sell the works to the city for $14,000,000. Two days later the city council accepted the offer by a unanimous vote of the members present, some of whom, it is reported, knew nothing of the proposal until the meeting. There ensued public protest against the price and the hasty action; the initiation of arbitration to fix the price to be paid, under an agreement by the company that the price should not exceed $14,000,000; injunctions against purchase under either plan; a libel suit; then annulment by the city council of all action in the matter thus far taken, to pave the way for statutory expropriation or condemnation proceedings.

The three condemnation commissioners—one chosen by the city, one by the company and a third by these two—made its award on March 12, 1928. More controversy followed, during which offers were made to the city to duplicate the property in question for considerably less than either the award or the original agreed-on price. When the city council put on first reading an ordinance providing for the acceptance of the award, a temporary injunction against the action was obtained, but after a prompt hearing it was dismissed.

On July 10 the council voted for the final passage of the ordinance, the last of several votes standing 23 for to 11 against. The mayor—a new incumbent of the office since the controversy began—refused to approve this action, so the necessary ordinances were signed by the chairman of the executive committee.

In its award the condemnation board put the value of the property as of Aug. 9, 1927, at $14,955,959. The board stated that a valuation of $9,800,000 had been urged upon it, on the ground that in November, 1926, the bulk of the stock of the company had changed hands on that basis. It disallowed the validity of

June, 1928, convention of the Society for the Promotion of Engineering Education at the University of North Carolina, Chapel Hill, N. C.

this claim because the condemnation statute provides that the value shall be actual value. W. J. Hagenah, of Chicago, valuation expert for the city, valued the property at $12,307,876 on an inventory basis and at $12,300,000 on an earnings basis. For the Montreal Water & Power Company, the American Appraisal Company gave $16,851,582 as the value of the property.

By mutual agreement the works in controversy have been operated and maintained by the city of Montreal since May, 1927, the company supplying funds for these purposes and for minor extensions, and collecting notes for water sold.

Previous notes and comments on this purchase controversy may be found in *Engineering News-Record*, March 10, 1927, p. 422; July 21, 1927, p. 115; Sept. 1, 1927, p. 330. The award of the condemnation board, in full, appeared in the issue of the Montreal *Gazette* of March 13, 1928.

Gooding Irrigation Project to Be Built

Secretary Hubert Work of the Department of the Interior announced on July 7 that President Coolidge had approved his recommendation of the feasibility of the gravity division of the Minidoka reclamation project in Idaho. Approval makes available an appropriation of $1,075,000 provided by the past Congress for this work.

The Minidoka project is an old one of the Reclamation Service and has already been providing irrigation water for some 120,000 acres. The Gravity Division, often called the Gooding project, will increase the irrigated area by 80,000 acres. The water to be used is from the American Falls reservoir of the Snake River, completed a year or two ago, and will be diverted at Milner dam on the Snake River, 25 miles east of Twin Falls, Idaho, and thence be carried by canal northwesterly 70 miles to an intersection with a constructed canal now serving lands in the vicinity of Gooding, Idaho. The latter canal is part of a system constructed under the Carey act 20 years ago for the irrigation by gravity of some 80,000 acres of land with water from Big Wood and Little Wood rivers, and for which the present water supply has been found uncertain and inadequate. The proposed canal will permit the waters from Big and Little Wood rivers, now being used below its level, to be devoted exclusively to the irrigation of 36,000 acres of higher lands, and will so augment the water supply for these higher lands as to permit profitable cultivation. In addition to this indirect irrigation the proposed government canal will be large enough to irrigate directly 80,000 acres of land, of which 60,000 acres are now in a position to be reclaimed and cultivated, and 20,000 acres of public land, hereinbefore referred to. The expenditure of $800,000 for laterals for this public land will not be made until settlement is assured.

Port Huron-Sarnia Bridge to Be Started Soon

The Port Huron-Sarnia bridge bill, providing for an international bridge across the St. Clair River connecting Port Huron, Mich., and Sarnia, Ont., has been signed by the President, and a companion bill has been passed by the two houses of the Canadian Parliament and received royal assent. Actual construction is expected to start Aug. 1. Financing has been arranged and a permit has been issued to Maynard D. Smith, Detroit. It is estimated that the bridge will become publicly owned in sixteen or seventeen years, in accordance with a recapture clause. Modjeski, Masters & Chase are the engineers.

Analyses of Greenville Dam Embankment Material

During a recent visit to the Table Rock dam of the Greenville (S. C.) water supply, which underwent a partial failure on May 4, 1928, E. S. Cullings, chief engineer of the Black River (N. Y.) Regulating District, collected a number of samples of the embankment material. These samples were subsequently analyzed by H. W. Clark, chief chemist of the Massachusetts Department of Health, by screening and elutriation. The samples were collected as follows:

Sample No. 1—From the original river bank at south (right) end of dam, 5 ft. below surface, at elevation of top of dam. Sample No. 2—"Blue clay," so called, from downstream face of dam, near right end, at edge of slump. Sample No. 4—Red clay from face of slump near right end of dam, one-third way down slope. Sample No. 5—Red clay from face of stable part of dam back of slump, near right end of dam. Material standing on slope of about 5 on 1. Sample No. 6—Red clay from face of slump, near foot of dam. Material "quaky" where wet.

Samples Nos. 4, 5 and 6 appeared to be generally characteristic of the embankment; only small deposits of "blue clay" (sample No. 2) were visible on the surface.

The results of the analyses are given in the table. In examining all of the samples, especially No. 1, considerable difficulty was experienced in disintegrating lumpy material. Much of the material passing the four finer sieves proved on examination to be lumps of very fine material and only by long-continued rubbing with a rubber-covered glass rod and washing with water could these aggregations of fine particles be completely broken up. The red color is largely due to the material finer than 0.022 mm., and the coarser material is largely light-colored, sharp sand. Sample No. 2 contained distinct particles of mica.

The specific gravity of sample No. 1 was determined and was found to be 2.54, or practically the same as that of Massachusetts sands which were used in measuring the size of particles separating out in different time periods in the elutriation process.

ANALYSES OF GREENVILLE DAM EMBANKMENT

Sample No.	1	2	4	5	6
Per cent by weight finer than:					
2-mesh sieve, or 12.0 mm.	100.0	.....	.....	.....	.....
4-mesh sieve, or 4.71 mm.	99.6	.....	100.0	.....	100.0
6-mesh sieve, or 3.50 mm.	99.0	100.0	99.8	100.0	99.2
10-mesh sieve, or 2.02 mm.	98.0	99.2	98.0	98.6	98.6
20-mesh sieve, or 0.97 mm.	96.0	96.0	95.2	97.8	95.2
40-mesh sieve, or 0.44 mm.	93.0	79.4	83.6	91.4	84.6
60-mesh sieve, or 0.25 mm.	86.6	60.4	67.8	80.8	68.4
100-mesh sieve, or 0.15 mm.	84.6	45.2	54.0	73.4	56.0
150-mesh sieve, or 0.10 mm.	80.6	28.6	40.6	62.4	45.6
200-mesh sieve, or 0.07 mm.	76.6	22.0	37.8	60.4	43.6
0.05 mm.	75.8	21.4	37.6	60.0	42.6
0.04 mm.	63.2	19.4	25.2	42.0	26.0
0.022 mm.	48.2	14.0	15.2	26.2	14.6
0.012 mm.	37.6	11.2	11.0	19.2	9.4
0.008 mm.	33.0	8.6	8.6	15.8	7.4
0.006 mm.	29.4	7.2	6.8	13.2	6.2
0.004 mm.	25.8	5.2	4.6	11.4	5.4

Cobble Mountain Dam and Tunnel Contracts Are Awarded

Contracts for the construction of the Cobble Mountain hydraulic-fill dam and outlet tunnel have been let by the board of Water Commissioners, Springfield, Mass. Winston & Company, Inc., Kingston, N. Y., was the successful bidder on the dam. Awarded on a unit price basis, this contract amounts to $1,437,000, using the engineers' estimated quantities. The tunnel contract was awarded to the Frazier-Davis Construction Company, St. Louis. Summarized unit prices on this contract amount to $651,000.

High summarized bids on the dam were $2,674,000, and on the tunnel $1,047,000.

In these columns two weeks ago it was erroneously reported that Winston & Company, Harrisburg, Pa., were one of the low bidders on the dam. This should have read Winston & Company, Inc., Kingston, N. Y.

Charles River Plan Board Named

A special commission of five to consider future plans for the utilization of the Charles River basin in Massachusetts has been named by Governor Fuller. The members are: Henry I. Harriman, chairman; Prof. George Owen, of the Massachusetts Institute of Technology; James W. Rollins, Henry Parkman, Jr., and Arthur A. Shurtleff. The task of the commission is to provide "means and methods of making the Charles River basin more safe, suitable and attractive for recreation."

WASHINGTON NOTES

By Paul Wooton
Washington Correspondent

Boulder Dam Problems—Barge Line Plans Undecided—Still Active in Public Utilities Quiz

UNDER the terms of the Senate resolution, no expressed authority is given the Boulder dam board to do more than to examine the proposed site of the dam and to review the plans and estimates made for that particular development. The board is called upon for advice as to the "safety, economic and engineering feasibility and adequacy of the proposed structure and incidental works." It is doubted at the Department of the Interior if this includes the All-American Canal or other matters that are not directly a part of the project planned at the dam site. It is recognized, however, that reports made under congressional resolutions frequently are much broader than are warranted by the specific language used.

On the other hand, the commission must submit its completed report by Dec. 1. Because of the short time for the study, it is expected that the board will be anxious to confine the report to the narrowest limits possible. It is not believed that any attempt will be made to deal with general problems pertaining to the Colorado River.

Members of the board will hold their first conference in Washington on July 30.

Barge Board to Report

No decision as to recommendations to be made to the Secretary of War in regard to the exact purposes for which the $10,000,000 authorized for the Inland Waterways Corporation shall be used was reached at the recent meeting of the corporation's advisory committee. There is difference of opinion as to whether or not the entire amount should be expended for additional equipment. To supply sufficient plant to handle all peaks of freight movement, some members of the board fear, would result in carrying charges likely to affect adversely the corporation's financial showing. On the other hand, the amount is insufficient to undertake the extension of the service to any important tributary. It is recognized that one of the greatest immediate needs is to extend joint rate agreements with the railroads. Since the passage of the Denison act, setting forth the policy of Congress to continue the experiment in waterway transportation until the joint rates are generally available, the railroads are showing more interest in the development of such tariffs. It is believed that this will do much to provide a better load factor in connection with the barge line operations. Individual members of the board have agreed to submit separate reports on the general question as to the disposition of the $10,000,000. When these reports have been completed a further meeting will be held.

Public Utilities Inquiry

The Federal Trade Commission now is actively at work on the second phase of its public utilities investigations. Twenty-six of its representatives now are busy taking pertinent information from the books of a number of the large holding companies. The remaining phases of the inquiry, the commission says in its monthly progress report, call for a high degree of specialized knowledge and experience. The staff of the commission has been augmented by a number of accountants with experience with state utility commissions.

Of the 10,211 questionnaires sent out at the beginning of the investigation to the privately owned utilities, 5,944 returns have been received. It has been learned, however, that a considerable number of the companies originally addressed have retired from business or have been absorbed by other companies or are not public utilities. It is estimated that less than 2,000 companies actively engaged in the utility business are still to be heard from.

Another lengthy and intricate questionnaire will be sent to the utility companies about Aug. 1.

Brief News

A Vehicular Tunnel between South Philadelphia and Gloucester, N. J., is being planned to take the place of the proposed Delaware River Bridge No. 2. Application has been made to the U. S. Army engineers for approval of the project. Tentative plans call for a single tube approximately 52 ft. below mean low tide where it passes under the main ship channel.

The New Yale Terminal of the St. Louis-San Francisco Railroad at Memphis, Tenn., has started operation. Construction of the yard took more than a year at a cost of approximately $1,750,000.

Immediate Construction of a Highway Bridge across the Red River between Fargo, N. D., and Moorhead, Minn., has been made possible by agreement between the North Dakota and Minnesota Highway Commissions. The estimated cost of $300,000 will be paid by the two states and the federal government.

New Terminal Facilities have been completed in Mobile, Ala., at a cost of $10,000,000. The plant consists of three piers, coaling facilities, and a system of tracks connecting with all railroads entering the city. The terminal will accommodate more than 30 vessels at one time, and is absolutely fireproof.

The Lancaster Freight Yards of the Texas & Pacific Railroad, west of Fort Worth, Tex., have been opened to traffic. The hump for gravity switching and the main yards include 60 miles of track and can handle 3,000 cars per day. Electrically controlled car retarders are used.

RANDOM LINES

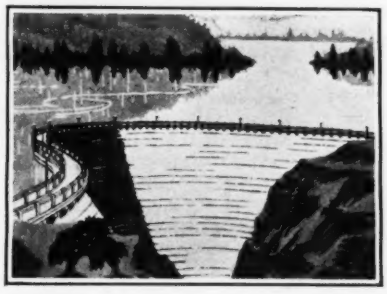
Leading Contender for 1928 Prize for Mixed Metaphor

"There is a time-worn illustration, which strikes harder now than when first uttered."—*An industrial engineer.*

* * *

Two Types of Arch Dams

Artists have added two new types of arch dams, the "rotund" and the "reverse curve." The latter, by the way,



is based upon the design of the Cushman dam, the artist having maintained the alignment of the crest while shifting the abutment for artistic effect.

* * *

Staggering Is Right

Here is an accurate statement sent out by the United Press:

ATLANTIC CITY, N. J. (U. P.).—An auditorium which will seat 40,000 people, all having an unobstructed view of the stage, is one of the features of the world's largest convention hall, now being built in Atlantic City, at a cost around $15,000,000.

There will be no cumbersome beams or massive girders to hold the roof of this unique building, yet the main hall will extend over a width of 350 ft. and a depth of 650 ft.

Accurate figures relating to measurements and quantities of various types of material used in the building of the hall are staggering. They include: *Twelve million tons* of structural steel, 42,000 cu.yd. of concrete, 65,000 barrels of cement, 25,000 tons of sand, 53,000 tons of mining stone, 2,000,000 sq.ft. of concrete forms and 10,000,000 bricks.

The italics are ours.

Engineering Societies

CALENDAR

ANNUAL MEETINGS

NEW ENGLAND WATER WORKS ASSOCIATION, Boston, Mass.; Annual Convention, Montreal, Canada, Sept. 18-21.

AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS, St. Louis, Mo.; Annual Convention, Detroit, Mich., Oct. 22-28.

THE INTERNATIONAL ASSOCIATION OF ROAD CONGRESSES has accepted the invitation of the United States government to hold its next Congress at Washington in October, 1930. About 1,000 European delegates are expected to attend.

THE AMERICAN CONCRETE INSTITUTE will hold its 25th annual convention in Detroit on February 12, 13 and 14, 1929. The Michigan State Engineering Conference, which is usually held at this time, will be omitted this year in deference to the American Concrete Institute convention.

THE CENTRAL STATES SECTION of the American Water Works Association will hold its annual meeting Aug. 23 and 24 at the Pritchard Hotel, Huntington, W. Va. E. E. Bankson, 813 Clark Building, Pittsburgh, Pa., is secretary.

THE INTERNATIONAL CITY MANAGERS' ASSOCIATION has decided upon a four-day convention this year, to be held at Asheville, N. C., Sept. 17 to 20. John G. Stutz, Lawrence, Kan., is secretary.

THE SAGUENAY BRANCH of the Engineering Institute of Canada has elected C. F. Layne, of the engineering staff of Price Bros., Ltd., Riverbend, Que., as president.

THE LONG BEACH (CALIF.) CHAPTER, American Association of Engineers, is sponsoring Engineers' Day at the Pacific Southwest Exposition on Aug. 4. The proposed California registration bill and other important matters pertaining to the profession will be discussed.

THE ENGINEERING INSTITUTE OF CANADA has published the first issue of the *E. I. C. News*, which will hereafter appear on Thursday of each week with the exception of the first Thursday of the month. A feature of the publication is the page devoted to opportunities for engineers, in connection with the employment service bureau. The publication will also carry items of interest to the profession.

THE SOUTHWEST WATER WORKS ASSOCIATION will hold its seventeenth annual convention Oct. 15-18 at the Baker Hotel, Dallas, Tex. Lewis A. Quigley, Fort Worth, Tex., is secretary.

THE PENNSYLVANIA SEWAGE WORKS ASSOCIATION and the PENNSYLVANIA WATERWORKS ASSOCIATION held a joint convention at State College, Pa., on July 14. Howard E. Moses, of the Pennsylvania State Health Department, was elected president of the sewer men, and, for the waterworks operators, M. B. Litch was chosen vice-president and I. M. Glace secretary-treasurer. Mr. Litch is chief chemist of the Steelton (Pa.), waterworks, and Mr. Glace is district engineer for the State Health Department.

THE SAN DIEGO (CALIF.) CHAPTER, American Association of Engineers, has elected the following officers: President, Robert F. Halley, Jr.; vice-president, E. Robinson Rowe; treasurer, Ernest R. Childs, county surveyor; recording secretary, Rolland A. Judson; corresponding secretary, Jewell E. Morrison.

Personal Notes

FREDERICK PALMER, prominent British engineer retained by the Canadian government last year in connection with the selection of a terminal port for the Hudson Bay Railway, has again been retained to study certain aspects of the Montreal terminal question. Mr. Palmer was in Montreal recently for a few days, and will return again in September to make fuller investigation along lines indicated by the federal authorities.

Major DONALD H. CONNOLLY has been transferred from Memphis, Tenn., to the Army War College in Washington. For five years Major Connolly has been in charge of the Mississippi River Commission districts, extending from Cairo, Ill., to Vicksburg, Miss.

Major FRANCIS B. WILBY, formerly of the General Staff, is now in charge of the first and second Mississippi River Commission districts, succeeding Major Donald H. Connolly.

ALLEN J. HAMILTON, for over three years a member of the Illinois State Highway Department, is now assistant city engineer of Harvey, Ill.

J. B. WESLEY has been appointed engineer of water service of the Missouri Pacific Railroad Company, with headquarters at St. Louis, succeeding H. H. Richardson, resigned.

V. F. W. FORNERET, who has been superintending engineer of the River St. Lawrence Ship Channel, has been appointed chief engineer of the River St. Lawrence Ship Channel, Marine and Fisheries Department, with headquarters at Ottawa, Ont.

N. B. MCLEAN, who has been engineer of the River St. Lawrence Ship Channel, has been appointed assistant chief engineer of the River St. Lawrence Ship Channel, Marine and Fisheries Department, with headquarters at Ottawa, Ont., during the winter season, and Sorel, Que., during the season of navigation.

Major W. D. STYER, according to recent army orders, will relieve Col. Robert L. Ralston as district engineer in charge of the first New York district of the Engineer Corps. The jurisdiction of this district extends from Lake Champlain down the Hudson River to the East and North River sections of New York harbor, including supervision over the operations of the lock and dams at Troy. Colonel Ralston will go to Washington as chief of the Military Division of the Corps of Engineers.

HOMER H. WYSS, for the past three years acting assistant chief engineer of construction of the Ohio Highway Department, has been advanced to the post of acting chief engineer of construction. He succeeds R. S. Beighler, now chief engineer of the department.

LELAND H. KIMBALL has been named a member of a special joint committee to make a study of the water problems Great Salt Lake Basin project in Utah.

NED H. SAYFORD, of Memphis, Tenn., is now in Dallas, Tex., in connection with the construction of a levee system along the Tennessee River.

R. E. J. SUMMERS, of the H. K. Ferguson Company, has been promoted from chief contracting engineer to vice-president in charge of contracts.

Major STUART C. GODFREY, engineer in charge of the government dredging fleet with headquarters at Memphis, Tenn., has been transferred to Fort Leavenworth, Kansas. He will be succeeded by Major EDWIN C. KELTON.

CARL A. HEINZE, engineer in charge of distribution for the Los Angeles, Calif., bureau of light and power for the past twelve years, has been advanced to the position of assistant chief electrical engineer of the bureau. He has been connected with the city's water and power engineering staff for 21 years, and of this period six years were spent as a designing and construction engineer on the Los Angeles aqueduct project.

OBITUARY

W. H. TIEDEMAN, principal assistant city engineer, Seattle, Wash., died on July 10 after a prolonged illness. Mr. Tiedeman was a native of Davenport, Ia., born in 1878, and was graduated from the University of Washington in 1901, at which time he joined the Seattle city engineering staff. He was made principal assistant city engineer in November, 1911, and became widely known as a leader in concrete paving design. Among other developments in that field he is credited with originating and being the first to use the "dummy" or weakened plane joints in concrete pavement.

WILLIAM F. HOWARD, vice-president and one of the founders of the Western Pipe & Steel Company of California, died at his home in Los Angeles on July 11. He was born in Ireland in 1862 and came to the United States in 1880.

Construction Equipment and Materials

Plans Being Made for 1928 Welding Exposition

More than half the space allotted to the exhibits of welding equipment which are shown in connection with the meeting of the American Welding Society, in Philadelphia, October 8-12, has been applied for. This convention, which is held in co-operation with the American Society for Steel Treating, covers the entire metal-working field. The exhibit this year will occupy all the floor space of the Exhibition Hall of the Commercial Museum, and five days will be devoted to displays of welding equipment and supplies and exhibits of welded products.

It is announced that technical meetings and registration will be held at the Bellevue-Stratford Hotel in the mornings and at the Exhibition Hall in the afternoon of each day. Companies which have already been assigned space are as follows:

Air Reduction Sales Co.
American Brass Co.
American Steel & Wire Co.
Bastian-Blessing Co.
Fusion Electric Welding Corporation.
General Electric Co.
Gibb Welding Machine Co.
K-G Welding & Cutting Co.
Lincoln Electric Co.
Linde Air Products Co.
Metal & Thermit Corporation.
Page Steel & Wire Co.
John A. Roebling's Sons Co.
R. D. Thomas & Co.
Torchweld Equipment Co.
Transportation Equipment Co.
Una Welding & Bonding Co.
Westinghouse Electric & Mfg. Co.
Wilson Welder & Metals Co.

Leipzig Trade Fair Extends Its Activities to Construction

The Leipzig Trade Fair, long the barometer of industrial Germany and including this year something over 10,000 exhibits, will feature many demonstrations of construction equipment. The fall Fair will be held from August 26 to September 1. At the spring Fair there were nearly 200 exhibits of road building and construction machinery and materials, of which 84 were open-air exhibits. Several miles of road were built in the vicinity to illustrate the operation of the newest machinery and materials employed. It is said that this practice will be repeated at the fall Fair.

FIG. 1—ONE OF THE PERMANENT BUILDINGS OF THE LEIPZIG TRADE FAIR

The Fair is housed twice a year in 100 special exhibition buildings. It is claimed that the newest of these buildings, which is used for the automobile exhibit, has more than twice the floor space of Madison Square Garden in New York City. During the Fair a number of important technical meetings are held covering different phases of construction work. Information concerning the Fair may be obtained by addressing the Leipzig Trade Fair, Inc., 11 West 42d St., New York City.

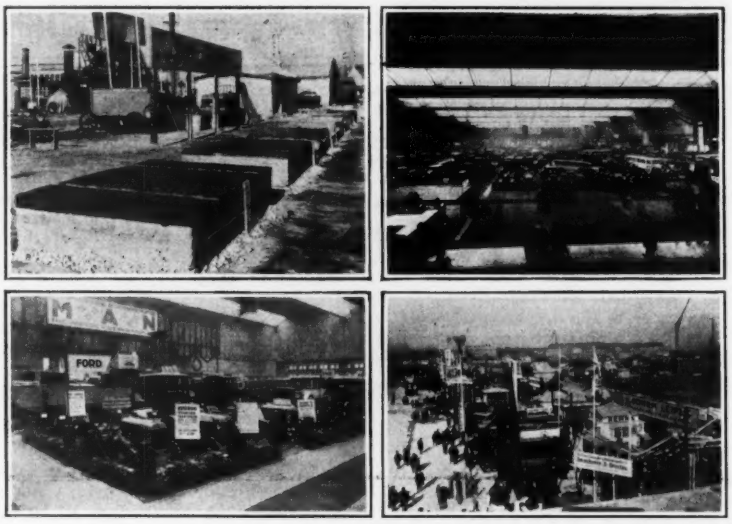


FIG. 2—VIEWS OF LEIPZIG TRADE FAIR SHOWING SOME OF THE INDOOR AND OUTDOOR EXHIBITS

Business Notes

CHICAGO PNEUMATIC TOOL COMPANY, New York City, announces the appointment of W. S. Lynch, former district manager at Seattle, to the position of district manager at Cincinnati, to succeed T. G. Smallwood, who has been granted an indefinite leave of absence on account of ill health. A. M. Andersen has been appointed acting district manager at Seattle.

YOUNG RADIATOR CO., Racine, Wis., announces that it has received a one-year contract from the Chicago Pneumatic Tool Company to manufacture a complete line of radiators for the latter company's portable compressors. The Young Radiator Co. also now manufactures equipment used on other portable compressor equipment, including Gardner-Denver Co., Rix Compressor Co. and the Independent Pneumatic Tool Co.

MUNDY SALES CORPORATION, 30 Church Street, New York City, announces the appointment of the following sales distributors: E. F. Craven Co., Greensboro, N. C., for western North Carolina; Lone Star Road Machinery Co., Dallas, Tex., for northwestern Texas; Nixon-Hasselle Co., Chattanooga, for eastern Tennessee; and R. P. Sweeney Co., Greenville, S. C., for the State of South Carolina.

WESTERN AMIESITE ASPHALT COMPANY, Chicago, announces that Louis Garbi has joined its organization as consulting engineer.

CHISHOLM-MOORE HOIST CORPORATION (DIVISION OF COLUMBUS MCKINNON CHAIN COMPANY, is the new name of the Chisholm-Moore Manufacturing Co., Cleveland. At a recent meeting, Julius F. Stone was elected president; Julius F. Stone, Jr., vice-president; J. C. Dunn, vice-president and treasurer; and Frederick Mitchell, secretary. John R. Mears continues as sales manager of the new corporation.

New Developments

New Belt Conveyor Carrier Made of Malleable Iron

A new belt conveyor carrier has just been announced by the Stearns Conveyor Company, Cleveland, Ohio, including among its noteworthy features supporting brackets made of certified

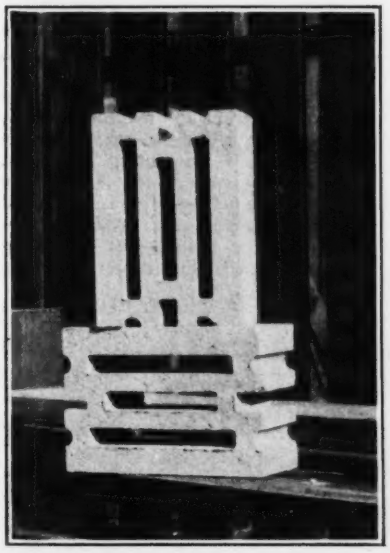
malleable iron. The manufacturers claim that a much stronger bracket has been designed than is possible in gray iron with no considerable increase in the total amount of metal used.

The spacing between idlers is reduced to 4½ in. on this new carrier. It is claimed that with this close spacing there is little chance of the belt "creasing" and being worn. In spite of the close spacing, any idler can be removed from the carrier without disturbing any of the others.

The carrier is offered in 18, 20, 24, 30 and 36 in. sizes, with either pressed steel or chilled-rim cast-iron idlers, both having one-piece pulley shell construction, Timken bearings, long-time lubrication, and a patented positive grease seal which serves the double purpose of keeping dust out of the idler and the grease within.

Maximum Insulation Claimed for New Tile Design

A novel design of cement tile for use in building walls is offered by the Airstone Sales Corporation, 32 West Randolph St., Chicago, Ill. A maximum amount of insulation is claimed for this tile, which has three independent dead-air spaces, each section continuous from floor to ceiling. Furring and lathing are unnecessary, as plaster may be applied directly to the inside face of the blocks. It is claimed that walls laid with



the new tile are absolutely watertight, conserve heat and prevent the transmission of exterior noises to the rooms of the building. The tiles are made of either stone or Haydite concrete. Watertightness is obtained by eliminating all through mortar joints or rather by breaking all joints by air spaces.

In order to insure complete bedding in mortar and the development of the full strength of the tile, the same company has developed a "Mortarshield," a patented device which enables the bricklayer to lay a tile in the time usually required to lay two bricks, gives a full mortar bed, and at the same time prevents blocking of the air-spaces by excess mortar.

New Material for Use in Place of Tarpaulins and Burlap

A new material, known as Sisalkraft, which can be put to many uses by the contractor, has recently been placed on the market by the Sisalkraft Company, 228 North LaSalle St., Chicago. Between two layers of heavy kraft paper

strong sisal fibers run crosswise in both directions, the whole being pressed together while hot under heavy pressure. Two heavy coatings of asphaltum are applied. The resulting Sisalkraft is not only waterproof but is hard to tear and wear-resisting. The way in which the sisal fibers are interlaced to reinforce the paper is shown in the illustration.

New uses for Sisalkraft are constantly being developed, according to the company. Contractors are using it in place of building paper for insulation, and also for covering temporary offices and tool rooms. It has been used to protect freshly finished floors from the shoes of the workmen. Being waterproof, it can be used to shelter supplies from the rain and dew, and also as a temporary window covering. When used as a covering for curing concrete roads in place of burlap, the Sisalkraft prevents the evaporation of moisture from the concrete and eliminates the necessity of constantly wetting the burlap.

Hopper Designed for Concrete Belt Conveyor Service

Since adapting its belt conveyors to carry wet concrete, the Barber-Greene Company, Aurora, Ill., has developed a hopper especially suitable for handling this type of material. The construction of the hopper is especially heavy to withstand the excessive load sometimes thrown on the conveyor. The tail pulley is larger and heavier than on a standard portable belt conveyor hopper in order to provide better traction for the belt and better to distribute the load throughout the hopper frame. The structural frame around the pulley is entirely open so as to keep the concrete from accumulating around the tail pulley and other moving parts. The hopper is narrower than the standard hopper in order to center the wet concrete so that it will not flow off the belt, and is higher, to take care of the necessary volume.

Manufacturers and Trade Associations

CALENDAR

ANNUAL MEETINGS

TRACK SUPPLY ASSOCIATION, Chicago; annual exhibition and convention, Detroit, Sept. 18-20, 1928.

CONCRETE REINFORCING STEEL INSTITUTE, Chicago; semi-annual meeting, Buckwood Inn, Shawnee-on-Delaware, Pa., October 1-3, 1928.

New Publications

Concrete in Architecture—PORTLAND CEMENT ASSOCIATION, Chicago, has published a 59-page cardboard-bound booklet on the subject of concrete in architecture. Its pages are devoted to unusual examples of the use of concrete as an architectural medium. Rather than treating the decorative uses for which concrete is adaptable, a few noteworthy examples in widely separated parts of the country are considered. Illustrations, in some cases colored, support the text. Special prominence has been given to the painting of concrete, and to the use of exposed aggregate concrete.

Batching Plants—ERIE STEEL CONSTRUCTION COMPANY, Erie, Pa., has published a series of folders describing its "Aggremeter" batching plants which are made in a variety of sizes and are equipped for either volume or weighing batch work. Line drawings are given showing the dimensions and complete specifications for the different types of plants available.

Traffic Signals—INTERFLASH SIGNAL CORPORATION, 120 Broadway, New York City, has published an eight-page booklet in which it has summarized its recommended practice for safeguarding all types of highway crossroads. It tells briefly when and where flashing caution signals should be used, how to properly safeguard irregular and regular intersections, and what it costs to operate such warning beacons. The company's flashing beacons are operated by acetylene.

Crusher and Sizing Screens—LUDLOW-SAYLOR WIRE CO., St. Louis, in its catalog No. 48 devotes 187 pages to detailed data on the various types of screens which it manufactures. Some of the important subjects considered are as follows: "Controlling Crusher Waste With Woven Screens"; "Points to Consider in Choice of Sizing Screens"; and "Complete Reference Data on Double-Strength Wire-Cloth and Woven Screens."

Steel Windows—BOGERT & CARLOUGH COMPANY, Paterson, N. J., has devoted a new catalog, J-28, to its projected windows with solid-steel sash. The catalog is a guide for ordering and specifying. It contains detailed illustrations and a table of standard types and sizes. A number of standard installation details are also included.

The Business Side of Construction

Cement Mills Feel Competition From Belgian Imports

No Revision Foreseen in Tariff Law; Labor and Transportation Costs Compared

THE saving of 9c. to 10c. per barrel to the contractor by using Belgian cement in preference to the American-made product is practically assured for some time to come, judging from the apparent lack of success attending efforts of the domestic producers to protect themselves against foreign competition. Dealers in New York pay $2.33 per barrel for domestic cement and $2.23 or $2.24 for Belgian. Belgium is the chief competitor in the foreign cement trade, since it furnishes about 72.5 per cent of total imports.

Cement is duty free and no revision of the tariff law is in sight at the next session of Congress. Furthermore, the Wood resolution, designed to make it compulsory that government purchasing agents require bidders to specify whether foreign or domestic material is to be used on federal government work, has not been passed after having been twice introduced in Congress. The object of this resolution was to establish preference for American-made material on public construction projects.

Growing demand for foreign cement is indicated in total imports for the first five months of 1928 of 1,075,058 bbl., against 875,988 bbl. in the same months last year, a gain of 23 per cent. Exports of 326,000 bbl. during this period were 30 per cent of imports and 5.7 per cent under the total exports for the corresponding months of 1927.

Regarding the severity of foreign competition at and around the ports of entry, C. H. Boynton, assistant to the president of the Atlas Portland Cement Company, says that "as a result the Eastern seaboard industry has been turning farther into the Middle West for an outlet, Southern mills farther up the Mississippi Valley, and Pacific mills deeper into the Rocky Mountain territory."

Labor and transportation costs, more than anything else, place Belgium in a favorable position in competition with American cement manufacturers.

The cement worker receives 12½c. per hour or $1 per day—less than one-fourth of the earnings of an American cement worker, who averages $4.50 per day. Belgian wages for all manual trades average about $6 per week.

Transportation costs are the next most important factor favoring foreign shippers. As an illustration, cement may be shipped from Antwerp to Philadelphia for 38c. per barrel, while the charge for shipping a barrel from the Lehigh Valley district to Philadelphia (71 miles) is 46c. From Antwerp to Miami the freight charge is 35c. per barrel, as against 56c. from the new Tampa mill to Miami.

In the period of heavy building, 1922 to 1927, inclusive, 11,054,961 bbl. of cement was imported from foreign countries through the following seaports: Boston, New York, Philadelphia, Norfolk, Charleston, Atlanta, Savannah, Miami, Tampa, New Orleans, Los Angeles and San Francisco.

E. N.-R. Index Numbers

Cost			Volume		
July 1,	1928	206.65	June,	1928	308
June 1,	1928	206.15	May,	1928	299
July 1,	1927	203.68	June,	1927	297
Average,	1927	206.24	Average,	1927	263
Average,	1926	208.03	Average,	1926	228
1913		100.00	1913		100

This Week's Contracts

Heavy construction contracts, reported by *Engineering News-Record* in the week ended July 24, with some comparisons, total as follows:

(In Thousands of Dollars, 000 Omitted)

Week Ended	Public	Private	Total
July 24, 1928	**$22,943**	**$29,435**	**$52,378**
July 17, 1928	30,063	36,621	66,684
July 26, 1927	20,416	53,778	74,194
Jan. 1 to July 24:			
1928	751,905	1,276,747	2,028,652
1927	693,733	1,061,826	1,755,559

Rents for Negro Properties in Six Cities

Rents for negro properties in a number of cities have been the subject of a study by the Institution of Social and Religious Research and the International Commission of Philadelphia. The accompanying table gives weekly rent figures in the six cities studied.

City	Dwellings Reporting	Rent Per Room	Rent Per Dwelling
Philadelphia	1932	$1.57	$7.95
Buffalo	49	1.36	9.02
Chicago (Lower North side)	500	1.25	....
Indianapolis	96	1.13	5.68
New York (Harlem)	747	1.66	7.19
Dayton	84	1.19	6.00
Gary	50	1.78	7.20

New Projects Planned Abroad

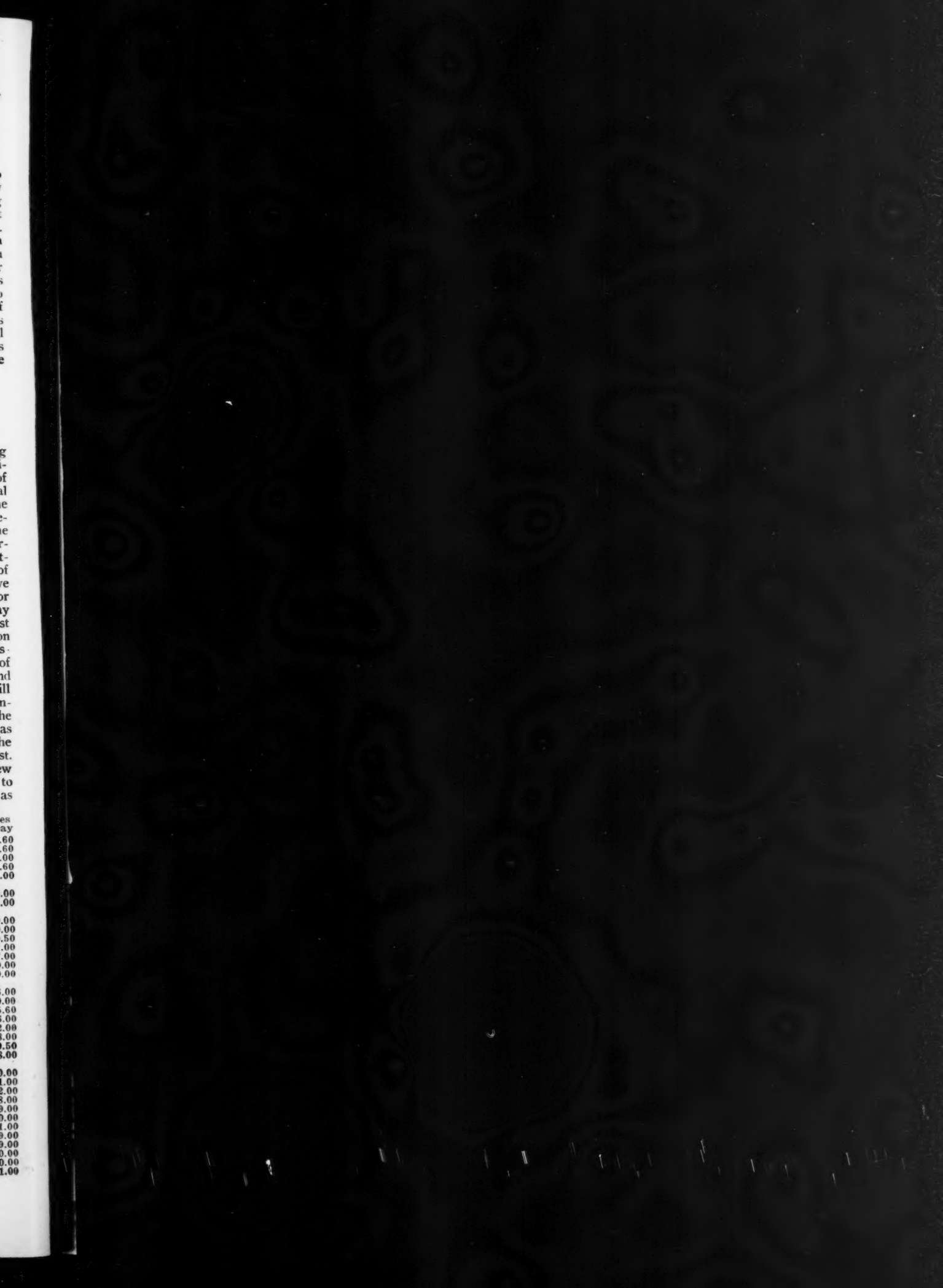
Among the foreign construction projects reported by the Department of Commerce are several that hold interest for American construction men. The Austrian government is studying three hydro-electric works on the Danube. The Peruvian government has granted a concession to Elias Bonnemaison, a local engineer, to survey a railway line between Castrovierreyna and the Port of Pisco. The Dutch government is contemplating building a synthetic ammonia plant near the state mine Maurits at Lutterdau, at an estimated cost of $5,037,000 for building and machinery.

Illinois' Largest Bond Issue Sold at Low Price

On July 17 Illinois sold to two financial groups the largest highway bond issue in its history. The offering amounts to $13,000,000 4 per cent bonds, and the winning bid was 96.2676. This is the lowest price brought by an Illinois issue in nearly five years. On May 15 the state sold $7,000,000 4 per cent bonds at 99.321. Three points difference in market price amounts to $390,000 in the case of an issue of $13,000,000. The reasons given for this drop are summer dullness in municipal markets, general decline in bond prices in the last 60 days and the unusual size of the offering.

Building Trades Agreement Signed in Seattle

A labor controversy of long standing in the Seattle building trades was officially settled when representatives of the Seattle Chapter, Associated General Contractors of America, and of the Building Trades Union signed an agreement settling their difficulties. The agreement is also approved by the chairman of the Citizens Industrial Adjustment Board. The two major points of difference between the factions have been recognition of a common labor union and the granting of a five-day week to the carpenters' union. The first question will be settled by a commission to be appointed by the Citizens Industrial Adjustment Board, to consist of representatives of the contractors and their employees. This commission will study the situation and make recommendations which will be adopted into the agreement. The carpenters' union was granted a five-day week during the months of May, June, July and August.

This agreement also ratifies a new wage scale for building operations to remain in force for three years, as follows:

	Wages Per Day
Building laborers	$5.60
Concrete and carpenters' helpers	5.60
Plasterers' hod carriers	8.00
Bricklayers' mortar men	6.60
Chimney and veneer work	7.00
Bridge and structural workers—	
Structural and ornamental iron men	10.00
Rodmen	9.00
Foremen ($1 over scale)	
Carpenters	9.00
Piledrivers	9.00
Boom men	9.50
Foremen	11.00
Millmen	7.00
Floorlayers	10.00
Electrical workers	10.00
Foremen ($1 over scale)	
Helpers	6.00
Hoisting and portable engineers	10.00
Marble, tile and terrazzo helpers	5.60
Floor machine men	6.00
Steam shovel men	12.00
Firemen	8.00
Crane men	9.50
Dinky runner	8.00
Lathers—	
Wood	10.00
Metal	11.00
Plasterers	12.00
Casters	8.00
Cement finishers	9.00
Composition workers	10.00
Plumbers	11.00
Painters	9.00
Roofers	9.00
Foremen	10.00
Sheet-metal workers	10.00
Steam fitters	11.00